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WILHELM WUNDT

OUTLINES OF PSYCHOLOGY

SECOND EDITION

J. Maurice Rogers

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OUTLINES
OF
PSYCHOLOGY

BY

WILHELM WUNDT

TRANSLATED WITH THE COOPERATION OF THE AUTHOR

BY

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TRANSLATOR'S PREFACE

TO FIRST ENGLISH EDITION.

THIS translation has been made with the cooperation of the author, who has not only contributed many valuable criticisms and suggestions in regard to terminology, but has read all the proof-sheets as they were being prepared for the press. A few verbal changes have been introduced into the text with a view to making the discussion somewhat clearer.

The difficulties that arise in choosing English equivalents for many German words, are too familiar to require detailed discussion. The translator has derived assistance in this respect from a comparison of other standard translations, especially the English versions of FALCKENBERG's "History of Modern Philosophy", WUNDT's "Lectures on Human and Animal Psychology", and KÜLPE's "Outlines of Psychology". The terminology here employed differs, however, at many points from that used in the works mentioned. A glossary of the principal terms has been added for the benefit of those familiar with the German. The translation of the word "*Perception*" is unusual. If it were translated 'perception' it would be easily confused, especially in its verbal forms, with the only possible equivalent of "*Wahrnehmung*", "*wahrnehmen*", and "*Anschauung*". Since the process referred to by "*Perception*" is so entirely different from that indicated by the English word perception, it seemed best to employ a word whose signification is not so fixed. Apprehension was, accordingly, used, and the danger of confusing it with the translation of "Auffassung" was for the most part avoided by using other equivalents for the latter.

The thanks of the translator are due to the author for his courtesy throughout the progress of the work. Mr. G. H. Stempel has kindly aided in the task of preparing the proof-sheets for the press.

Middletown, September, 1896.

C. H. J.

AUTHOR'S PREFACE
TO THE FIRST GERMAN EDITION.

THIS book has been written primarily for the purpose of furnishing my students with a brief manual to supplement the lectures on Psychology. At the same time it aims to give the wider circle of scientific scholars who are interested in psychology, either for its own sake or for the sake of its applications, a systematic survey of the fundamentally important results and doctrines of modern psychology. In view of this double purpose, I have limited myself in detailing facts to that which is most important, or to the examples that serve most directly the ends of illustration, and have omitted entirely those aids to demonstration and experiment which are properly made use of in the lecture-room. The fact that I have based this treatise on the doctrines that I have come to hold as valid after long years of labor in this field, needs no special justification. Still, I have not neglected to point out both in a general characterization (Introduction § 2), and with references in detail, the chief theories that differ from the one here presented.

The relation in which this book stands to my earlier psychological works will be apparent after what has been said. The "*Grundzüge der physiologischen Psychologie*" aims to bring the means employed by the natural sciences, especially by physiology, into the service of psychology, and to give a critical presentation of the experimental methods of psychology, which have developed in the last few decades, together with their chief results. This special problem rendered necessary a relative subordination of the general psychological points of view. The second, revised edition of the "*Vorlesungen über die Menschen- und Thierseele*"[1] (the first edition has long been out of date) seeks to give a more popular account of the character and purpose of experimental psychology, and to discuss from the position thus defined those psychological questions which are also of more general philosophical importance. While the treatment in the "*Grundzüge*" is, accordingly, determined, in the main, by the relations of psychology to physiology, and the treatment in the "*Vorlesungen*" by philosophical interests, this *Outlines* aims to present psychology in its own proper coherency, and in the systematic order that the nature of the subject-matter seems to me to require. In doing this, however, it takes up only what is most important and essential. It is my hope that this book will not be an entirely unwelcome addition even for those readers who are familiar with my earlier works as well as with the discussion of the "*Logik der Psychologie*" in my "*Logik der Geisteswissenschaften*" *(Logik, 2. Aufl., II, 2. Abth.)*.

I have not thought it necessary to repeat here the references to psychological works, in view of the fact that I have given such references very fully under the various heads in my "*Grundzüge*". The reader who wishes to make a more thorough study of any particular question will turn in any case to the more elaborate work. For the literature that has appeared in this department since the fourth edition of the "*Grundzüge*" (1893), the reader has but to refer to the last volumes of the various periodicals devoted to psychology: to the "*Philosophische Studien*", the "*Zeitschrift für Psychologie und Physiologie der Sinnesorgane*", the "*American Journal of Psychology*", and the "*Psychological Review*". The last three contain also reviews of the current literature in psychology. As a recent addition to these the "*Psychologische Arbeiten*" edited by E. KRAEPELIN and devoted especially to individual characterology and practical psychology, may be mentioned.

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[1] Translated by Prof. J. E. Creighton and Prof. E. B. Titchener: "*Lectures on Human and Animal Psychology*", Swan Sonnenschein & Co., 1894.

Leipzig, January, 1896.

W. Wundt.

AUTHOR'S PREFACE
TO THE FOURTH GERMAN EDITION.

THIS fourth edition contains more additions and minor revisions than do the second and third editions. The chief change is one which I have introduced in compliance with a request that has frequently been made; this change consists in the addition of brief lists of reading references at the end of each of the sections and chief divisions. These references, in keeping with the general character of the book, must of course be limited to the most important contributions to the discussions in question; and not all the important references can be given, but those must be selected which will furnish the reader who wishes to go into the subject more thoroughly with easy means of finding further references for his study. Sections of my "*Grundzüge der psysiologischen Psychologie*", and my "*Vorlesungen über die Menschen- und Thierseele*", which have been included in these lists of references are cited from the fourth and third editions respectively, and are referred to by abbreviated titles 1).

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1) In the English edition the titles have been given in full, that of the Grundzüge in its German form, that of the Vorlesungen in the form adopted by the translators, "*Lectures on Human and Animal Psychology*". Tr.

The "*Lectures*" may serve in a certain sense as a supplement to the "*Outlines*", for the Lectures contain a more complete elementary discussion of the experimental methods of psychology and also certain diagrammatic figures. For the benefit of readers of the Outlines who are not otherwise supplied with these aids, I have given page and number references to the figures in the Lectures.

Leipzig, March, 1901.

W. Wundt.

TRANSLATOR'S PREFACE

TO THE SECOND ENGLISH EDITION.

THIS second edition includes all that the author has incorporated in the fourth German edition. The most extended additions to the text are to be found on the following pages of this edition: 18—20, 50, 78—79, 94, 97—99, 108, 110—113, 127, 138, 184—185, 192—193, 221—222, 232—233, 248—251, 271—274, 285—286, 306—307, 330, 341—345, 346—349. There are also a number of lesser revisions. The reading references which the author inserted in his fourth edition are repeated without change of any kind except the substitution of English titles for German titles wherever this was possible. Since the references are presented by the author as a selected bibliography, it did not seem wise to make any additions. The pages on which these referenes appear in this edition are given in the index under "References".

Changes have been freely introduced in the phraseology of the English translation. It has not been necessary to make any significant changes in the terminology adopted for the earlier edition. The translator is under obligations to the reviewers of his work, and to a number of those who have used the book as a class text-book for suggestions of which he has taken advantage in his work of revision. It is hoped that these friendly critics will find the present form of the translation improved at points where the earlier edition may have been open to objection. Finally, the translator wishes to acknowledge his obligations to the publisher who has spared no pains in effort to make as easy as possible the difficult task of putting an English book through a German press.

New Haven, 1902.

C. H. J.

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INTRODUCTION.

§ 1. PROBLEM OF PSYCHOLOGY.

1. Two definitions of psychology have been the most prominent in the history of this science. According to one Metaphysical
psychology is the "science of mind": psychical processes are regarded as phenomena from which it is possible to infer the nature of an underlying metaphysical mind-substance. According to the other, psychology is the "science of inner Empirical
experience": psychical processes are here looked upon as belonging to a specific form of experience, which is readily distinguished by the fact that its contents are known through "introspection", or through the "inner sense", as it is called, if one uses the phrase which has been employed to distinguish introspection from sense-perception through the outer senses.

Neither of these definitions, however, is satisfactory to the psychology of to-day. The first, or metaphysical, definition belongs to a period of development that lasted longer in this science than in others, but is here too forever left behind, since psychology has developed into an empirical discipline, operating with methods of its own; and since the "mental sciences" have gained recognition as a great department of scientific investigation, distinct from the sphere of the natural sciences, and requiring as a general ground-work an independent psychology, free from all metaphysical theories.

The second, or empirical, definition, which sees in psychology a "science of inner experience", is inadequate because it may give rise to the misunderstanding that psychology has to do with objects totally different from the objects of so-called "outer experience". It is, indeed, true that there are certain contents of experience which belong in the sphere of psychological investigation, and are not to be found among the objects and processes studied by natural science: such are our feelings, emotions, and decisions. On the other hand, there is not a single natural phenomenon that may not, from a different point of view, become an object of psychology. A stone, a plant, a tone, a ray of light, are, when treated as natural phenomena, objects of mineralogy, botany, physics, etc. In so far, however, as they are at the same time *ideas*, they are objects of psychology, for psychology seeks to account for the genesis of these ideas, and for their relations, both to other ideas and to those psychical processes, such as feelings, volitions, etc., which are not referred to external objects. There is, then, no such thing as an "inner sense" which can be regarded as an organ of introspection, and as distinct from the outer senses, or organs of objective perception. The ideas of which psychology seeks to investigate the attributes, are identical with those upon which natural science is based; while the subjective activities of feeling, emotion, and volition, which are neglected in natural science, are not known through special organs, but are directly and inseparably connected with the ideas referred to external objects.

2. It follows, then, that the expressions outer and inner experience do not indicate different objects, but *different points of view* from which we take up the consideration and

Psych-sc. of immediate experien

scientific treatment of a unitary experience. We are naturally led to these points of view, because every concrete experience immediately divides into *two factors*: into a *content* presented to us, and our *apprehension* of this content. We call the first of these factors *objects of experience*, the second, *experiencing subject*. This division indicates two directions for the treatment of experience. One is that of the *natural sciences*, which concern themselves with the *objects* of experience, thought of as independent of the subject. The other is that of *psychology*, which investigates the whole content of experience in its relations to the subject and also in regard to the attributes which this content derives directly from the subject. The point of view of natural science may, accordingly, be designated as that of *mediate experience*, since it is possible only after abstracting from the subjective factor present in all actual experience; the point of view of psychology, on the other hand, may be designated as that of *immediate experience*, since it purposely does away with this abstraction and all its consequences.

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3. The assignment of this problem to psychology, making it a general, empirical science coordinate with the natural sciences, and supplementary to them, is justified by the method of all the *mental sciences*, for which psychology furnishes the basis. All of these sciences: philology, history and political and social science, have as their subject-matter, immediate experience as determined by the interaction of objects with knowing and acting subjects. None of the mental sciences employs the abstractions and hypothetical supplementary concepts of natural science; quite otherwise, they all accept ideas and the accompanying subjective activities as immediate reality. The effort is then made to explain the single components of this reality through their mutual interconnections. This method of psychological

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interpretation employed in *each* of the special mental sciences, must also be the mode of procedure in psychology itself.

3a. Since natural science investigates the content of experience after abstracting from the experiencing subject, its problem is usually stated as that of acquiring "knowledge of the outer world". By the expression outer world is meant the sum total of all the objects presented in experience. The problem of psychology has sometimes been correspondingly defined as "self-knowledge of the subject". This definition is, however, inadequate, because the interaction of the subject with the outer world and with other similar subjects is just as much a part of the problem of psychology as are the attributes of the single subject. Furthermore, the expression can easily be interpreted to mean that the outer world and the subject are separate components of experience, or, at least, components which can be distinguished as independent contents of experience, whereas, in truth, outer experience is always connected with the apprehending and knowing functions of the subject, and inner experience always contains ideas from the outer world as indispensable components. This interconnection is the necessary result of the fact that in reality experience is not a mere juxtaposition of different elements, but a single organized whole which requires in each of its components the subject that apprehends the content, and the objects that are presented as content. For this reason natural science can not abstract from the knowing subject entirely, but only from those attributes of the subject which either disappear entirely when we remove the subject in thought, as, for example, the feelings, or from those attributes which, on the ground of physical researches, must be regarded as belonging to the subject, as, for example, the qualities of sensations. Psychology, on the contrary, has as its subject of treatment the *total* content of experience in its immediate character.

The only ground, then, for the division between natural science on the one hand, and psychology and the mental sciences on the other, is to be found in the fact that all experience contains as its factors a content objectively presented, and an experiencing subject. It is to be noted, however, that it is by no means necessary that *logical* definitions of these two factors should precede the separation of the sciences from one another, for it is obvious that such definitions are possible only after they have a basis in the investigations of natural science and of psychology, they can never precede these investigations. All that it is necessary to presuppose at first, is the consciousness which accompanies all experience, that in this experience objects are being presented to a subject. There can, at this early stage, be no knowledge of the conditions upon which the distinction is based, or of the definite characteristics by which one factor is to be distinguished from the other. Even the use of the terms object and subject in this connection must be regarded as the application to the first stage of experience, of distinctions which are reached only through developed logical reflection.

The forms of interpretation in natural science and psychology are supplementary, not only in the sense that the first considers objects after abstracting, as far as possible, from the subject, while the second has to do with the part which the subject plays in the rise of experience; but they are also supplementary in the sense that each takes a different point of view in considering any single content of experience. Natural science seeks to discover the nature of objects without reference to the subject. The knowledge that it produces is therefore *mediate* or *conceptual*. In place of the immediate objects of experience, it sets concepts gained from these objects by abstracting from the subjective components of our ideas. This abstraction makes it necessary, continually to supplement reality with hypothetical elements. Scientific analysis shows that many components of experience — as, for example, sensations — are subjective effects of objective processes. These objective processes in their objective character, independent of the subject, can therefore never be a part of experience. Science makes up for this lack of direct contact with the objective processes by forming supplementary hypothetical concepts of the objective properties of matter. Psychology, on the other hand, investigates the contents of experience in their complete and actual form, both the ideas that are referred to objects, and also the subjective processes that cluster about these ideas. The knowledge

Psy. immediate + perceptual

thus gained in psychology is, therefore, *immediate* and *perceptual*: perceptual in the broad sense of the term in which, not only sense-perceptions, but all concrete *reality* is distinguished from all that is abstract and conceptual in thought. Psychology can exhibit the interconnection of the contents of experience, as these interconnections are actually presented to the subject, only by avoiding entirely the abstractions and supplementary concepts of natural science. Thus, while natural science and psychology are both empirical sciences in the sense that they aim to explain the contents of experience, though from different points of view, it is obvious that, in consequence of the special character of its problem, psychology is the *more strictly empirical.*

§ 2. GENERAL FORMS OF PSYCHOLOGY.

1. The view that psychology is an empirical science which deals, not with a limited group of specific contents of experience, but with the immediate contents of all experience, is of recent origin. It encounters even in the science of to-day hostile views, which are to be looked upon, in general, as the survivals of earlier stages of development, and which are in turn arrayed against one another according to their attitudes on the question of the relations of psychology to philosophy and to the other sciences. On the basis of the two definitions mentioned above (§ 1, 1) as being the most widely accepted, two chief forms of psychology may be distinguished: *metaphysical psychology* and *empirical psychology*. Each is further divided into a number of special tendencies.

Metaphysical psychology generally values very little the empirical analysis and causal interpretation of psychical processes. Regarding psychology as a part of philosophical metaphysics, its chief effort is directed toward the discovery of a definition of the "nature of mind" that shall be in accord with the metaphysical system to which the particular form of psychology belongs. After a metaphysical concept of mind has thus been established, the attempt is made to deduce from it the actual content of psychical experience. The characteristic that distinguishes metaphysical psychology from empirical psychology is, then, to be found in the attempt of metaphysical psychology to deduce psychical processes, not from other psychical processes, but from some substratum entirely unlike these processes themselves: either from the manifestations of a special mind-substance, or from the attributes and processes of matter. According as the substratum of psychical processes is defined in the one way or the other, metaphysical psychology branches off in *two* directions. In the first place, it may become *spiritualistic psychology*, in which case it considers psychical processes as the manifestations of a *specific* mind-substance and regards this mind-substance either as essentially different from matter (*dualism*), or as related in nature to matter (*monism* or *monadology*). The metaphysical tendency of spiritualistic psychology is expressed in the assumption of the *supersensible* nature of mind, and in connection with this, the assumption of the immortality of the mind. Sometimes the further notion of preexistence is also added. In the second place metaphysical psychology may become *materialistic psychology*. It then refers psychical processes to the *same* material substratum as that which natural science employs for the hypothetical explanation of natural phenomena. According to this view, psychical processes, like physical vital processes, are connected with certain organizations of material particles which are formed during the life of the individual and broken up at the end of that life. The metaphysical character of this form of psychology is determined by its denial that the mind is supersensible in its nature as is asserted by spiritualistic psychology. In order to make good its position such a

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materialistic form of psychology resorts to one of the two following devices. It may explain the content of psychological experience by means of a vague and inexact theory of molecular processes in the brain (*mechanical* materialism); or it may regard sensation as a necessary attribute, either of all material particles, or else of brain molecules in particular, in which case it treats all complex mental processes as combinations of such sensations, and explains their rise as the result of various combinations of physical brain processes (*psycho-physical* materialism). Materialism in its various forms and spiritualistic psychology in its various forms, agree in this: they do not seek to interpret psychical experience, by experience itself, but rather attempt to derive this experience from some kind of presuppositions in regard to hypothetical processes which are assumed to take place in some metaphysical substratum.

2. From the strife that followed these attempts at metaphysical explanation, *empirical psychology* arose. Wherever empirical psychology is consistently carried out, it either strives to arrange psychical processes under general concepts derived directly from the interconnection of these processes themselves, or it begins with certain of these processes, as a rule with the simpler ones, and then explains the more complicated processes as the results of the interaction of those with which it began. There may be various fundamental principles upon which to base such an empirical interpretation, and thus it becomes possible to distinguish several varieties of empirical psychology. In general, these may be classified according to *two* principles of division. The *first principle* has reference to the relation of inner and outer experience, and to the attitude which the two branches of empirical science, namely, natural science and psychology, take toward each other. The *second principle* refers to the

facts themselves, or to the derived concepts which are employed in the interpretation of mental processes. Every system of empirical psychology takes its place under both of these principles of classification.

3. On the *general question as to the nature of psychical experience* there stand over against each other the two forms of psychology already mentioned (§ 1) on account of their decisive significance in determining the problem of psychology: *psychology of the inner sense*, and *psychology as the science of immediate experience.* The first treats psychical processes as contents of a *special* sphere of experience coordinate with the sphere of experiences which are derived through the outer senses, and are assigned to the natural sciences. It also holds that the two spheres of experience though coordinate are totally different from each other. The second form of psychology, namely, psychology as the science of immediate experience, recognizes no real difference between inner and outer experience, but finds the distinction only in the different *points of view* from which unitary experience is considered in the two cases.

The first of these two varieties of empirical psychology is the older. It arose primarily through the effort to establish the independence of psychological observation, in the face of the encroachments of natural philosophy. In thus coordinating natural science and psychology, it sees the justification for the equal recognition of both spheres of science in the fact that they have entirely different objects and modes of perceiving these objects. This view has influenced empirical psychology in two ways. First, it favored the opinion that psychology should employ empirical methods, at the same time holding that these methods, like psychological experience, should be fundamentally different from those of natural science. Secondly, it gave rise to the necessity of showing some connection or other between these two kinds of experience, which were supposed to be different. In response to the first demand, it was chiefly the psychology of the inner sense that developed the method of *pure introspection* (§ 3, 2). In attempting to solve the second problem, this psychology was necessarily driven back to a metaphysical basis, because of its assumption of a difference between the physical and the psychical contents of experience. For, from the very nature of the case, it is impossible, from the position here taken, to explain the relations of inner to outer experience, or the so-called "interaction between body and mind", except through metaphysical presuppositions. These presuppositions must then, in turn, affect the psychological investigation itself in such a way as to result in the importation of metaphysical hypotheses into it.

4. Essentially distinct from the psychology of the inner sense is the form of psychology which defines itself as "the science of immediate experience". Regarding, as it does, outer and inner experience, not as different parts of experience, but as different ways of looking at one and the same experience, this form of psychology cannot admit any fundamental difference between the methods of psychology and those of natural science. It has, therefore, sought above all to cultivate *experimental* methods which shall lead to just such an exact analysis of psychical processes as that which the explanatory natural sciences undertake in the case of natural phenomena, the only differences being those which arise from the diverse points of view. This form of psychology holds, furthermore, that the special mental sciences which have to do with concrete mental processes and creations, stand on the same basis as itself, that is, on the basis of a scientific consideration of the immediate contents of experience and of their relations to acting subjects. It follows, then, that psychological analysis of the most general

mental products, such as language, mythological ideas, and laws of custom, is to be regarded as an aid to the understanding of all the more complicated psychical processes. In its methods, accordingly, this form of psychology stands in close relation to other sciences: as *experimental* psychology, to the natural sciences; as *social psychology*, to the special mental sciences.

Finally, from this point of view, the question of the relation between psychical and physical objects disappears entirely. They are not different objects at all, but one and the same content of experience. This content is examined in the one case, that is, in the natural sciences, after abstracting from the subject. In the other case, that is, in psychology, it is examined with a view to discovering its immediate character and its complete relation to the subject. All metaphysical hypotheses as to the relation of psychical and physical objects are, when viewed from this position, attempts to solve a problem that never would have existed if the case had been correctly stated. Psychology must then dispense with metaphysical supplementary hypotheses in regard to the interconnection of psychical processes, because these processes are the immediate contents of experience. Another method of procedure, however, is open since inner and outer experience are supplementary points of view. Wherever breaks appear in the interconnection of psychical processes, it is allowable to carry on the investigation according to the physical methods of considering these same processes, in order to discover whether the absent link can be thus supplied. The same holds for the reserve method of filling up the breaks in the continuity of our physiological knowledge, by means of elements derived from psychological investigation. Only on the basis of such a view, which sets the two forms of knowledge in their true relation, is it possible for psychology to become in the fullest sense an empirical science. Only in this way, too, can physiology become the true supplementary science of psychology, and psychology, on the other hand, the auxiliary of physiology.

5. Under the *second* principle of classification mentioned above (2), that is, the *principle based on the facts or concepts with which the investigation of psychical processes begins*, there are *two* varieties of empirical psychology to be distinguished. They are, furthermore, successive stages in the development of psychological interpretation. The first corresponds to a *descriptive*, the second to an *explanatory* stage. The attempt to present a discriminating description of the different psychical processes, gave rise to the need of an appropriate *classification*. Class-concepts were formed, under which the various processes were grouped; and the attempt was made to satisfy the need of an interpretation in each particular case, by subsuming the components of a given compound process under their proper class-concepts. Such concepts are, for example, sensation, knowledge, attention, memory, imagination, understanding, and will. They correspond to the general concepts of physics which are derived from the immediate perception of natural phenomena, such as weight, heat, sound, and light. Like those concepts of physics, the derived psychical concepts mentioned may serve as a first means of grouping the facts, but they contribute nothing whatever to the explanation of these facts. Empirical psychology has, however, often been guilty of confounding this description with explanation. Thus, the *faculty-psychology* considered these class-concepts as psychical forces or faculties, and referred psychical processes to their separate or united activity.

6. Opposed to this method of treatment found in descriptive faculty-psychology, is that of *explanatory* psychol-

ogy. When consistently empirical, the latter must base its interpretations on certain facts which themselves belong to psychical experience. These facts may, however, be taken from different spheres of psychical activity, and so it comes that explanatory treatment may be further divided into *two* varieties that correspond respectively to the two factors, objects and subject, which go to make up immediate experience. When the chief emphasis is laid on the *objects* of immediate experience, *intellectualistic psychology* results. This attempts to derive all psychical processes, especially the subjective feelings, impulses, and volitions, from *ideas*, or *intellectual processes* as they may be called on account of their importance for knowledge of the objective world. If, on the contrary, the chief emphasis is laid on the way in which immediate experience arises in the subject, there results a variety of explanatory psychology which attributes to those subjective activities which are not referred to external objects, a position as independent as that assigned to ideas. This variety has been called *voluntaristic psychology*, because of the importance that must be conceded to volitional processes in comparison with other subjective processes.

Of the two varieties of psychology which result from the different general attitudes on the question of the nature of inner experience (3), that form which we have called psychology of the inner sense commonly tends towards intellectualism. This is due to the fact that, when the inner sense is coordinated with the outer senses, the contents of psychical experience which first attract consideration are those which are presented as objects to this inner sense, in a manner analogous to that in which natural objects are presented to the outer senses. It is assumed, accordingly, that the character of objects can be attributed to *ideas* alone of all the contents of psychical experience, because ideas are regarded as *images* of the external objects presented to the outer senses. Ideas are, thus, looked upon as the only real objects of the inner sense, while all processes not referred to external objects, as, for example, the feelings, are interpreted as obscure ideas, or ideas related to one's own body, or, finally, as effects arising from combinations of ideas.

The psychology of immediate experience (4), on the other hand, tends toward voluntarism. It is obvious that here, where the chief problem of psychology is held to be the investigation of the subjective rise of all experience, special attention will be devoted to those factors from which natural science abstracts.

7. *Intellectualistic* psychology has in the course of its development separated into *two* forms. In one, the *logical* processes of judgment and reasoning are regarded as the typical forms of all psychoses; in the other, certain combinations of successive memory ideas distinguished by their frequency, the so-called *associations of ideas*, are accepted as typical. The *logical theory* is most clearly related to the popular method of psychological interpretation and is, therefore, the older. It finds some acceptance even in modern times. The *association theory* arose from the philosophical empiricism of the last century. The two theories stand, to a certain extent, in antithesis, since the first attempts to reduce the totality of psychical processes to higher processes, while the latter seeks to reduce this same totality of processes to lower and, as it is assumed, simpler forms of intellectual activity. Both are one-sided, and not only fail to explain affective and volitional processes on the basis of the assumption with which they start, but are not able to give a complete interpretation even of the intellectual processes.

8. The union of psychology of the inner sense with the intellectualistic view has led to a peculiar assumption that

has been in many cases fatal to psychological theory. We may define this assumption briefly as the *erroneous and intellectualistic attribution of the nature of things, to ideas.* Not only was an analogy assumed between the objects of the so-called inner sense and those of the outer senses, but the former were regarded as the images of the latter; and so it came that the attributes which natural science ascribes to external objects, were transferred to the immediate objects of the "inner sense", that is, to ideas. The assumption was made, accordingly, that ideas are themselves permanent things, just as much as the external objects to which we refer them; that these ideas disappear from consciousness and come back into it; that they may, indeed, be more or less intensely and clearly perceived, according as the inner sense is stimulated through the outer senses or not, and according to the degree of attention concentrated upon them, but that on the whole they remain unchanged in qualitative character.

9. In all these respects *voluntaristic psychology* is opposed to intellectualism. While the latter assumes an inner sense and specific objects of inner experience, voluntarism is related to the view that inner experience is identical with *immediate* experience. According to this doctrine, the content of psychological experience does not consist of a sum of objects, presented to the subject, but it consists of all that which makes up the process of experience, that is, of all the experiences of the subject in their immediate character, unmodified by abstraction or reflection. It follows of necessity that the contents of psychological experience are here regarded as an *interconnection of processes.* Psychical facts are *occurrences,* not objects; they take place, like all occurrences, in time and are never the same at a given point in time as they were the preceding moment. In this sense *volitions* are *typical* of all psychical processes. Voluntaristic

psychology does not by any means assert that volition is the only real form of psychosis, but merely that, with its closely related feelings and emotions, volition is just as essential a component of psychological experience as are sensations and ideas. It holds, further, that all other psychical processes are to be thought of after the analogy of volitions, they too being a series of continuous changes in time, not a sum of permanent objects, as intellectualism generally assumes in consequence of its erroneous attribution to ideas of those properties which we attribute to external objects. The recognition of the *immediate* reality of psychological experience renders impossible any attempt to derive the particular components of psychical phenomena from processes specifically different from the experiences themselves. The analogous attempts of metaphysical psychology to derive all conscious processes from imaginary processes of an hypothetical substratum, are for the same reason inconsistent with the real problem of psychology. While psychology concerns itself, accordingly, with immediate experience, it nevertheless assumes from the first that all psychical contents contain objective as well as subjective factors. These are to be distinguished only through deliberate abstraction, and can never appear as really separate processes. In fact, observation teaches that there are no ideas which do not arouse in us feelings and impulses of different intensities, and also that a feeling or a volition which does not refer to some ideated object is altogether impossible.

10. The governing principles of the psychological position maintained in the following chapters may be summed up in *three* general statements.

1) Inner, or psychological, experience is not a special sphere of experience apart from others, but is *immediate experience* in its totality.

2) This immediate experience is not made up of unchanging contents, but of an *interconnected system of occurrences*; not of objects, but of *processes*, of *universal human experiences* and their relations in accordance with certain laws.

3) Each of these processes contains an *objective content* and a *subjective process*, thus including the general conditions both of all knowledge and of all practical human activity.

Corresponding to these three general principles, we have a *threefold relation of psychology* to the other sciences.

1) As the science of immediate experience, it is *supplementary* to the *natural sciences*, which, in consequence of their abstraction from the subject, have to do only with the objective, *mediate* contents of experience. Any particular fact can, strictly speaking, be understood in its full significance only after it has been subjected to the analyses of both natural science and psychology. In this sense, then, physics and physiology are auxiliary to psychology, and the latter is, in turn, supplementary to the natural sciences.

2) As the science of the universal forms of immediate human experience and their combination in accordance with certain laws, it is the *foundation of the mental sciences*. These sciences treat in all cases of the activities issuing from immediate human experiences, and of the effects of such activities. Since psychology has for its problem the investigation of the forms and laws of these activities, it is at once the most general mental science, and the foundation of all the others, that is, of philology, history, political economy, jurisprudence, etc.

3) Since psychology pays equal attention to *both* the subjective and objective conditions which underlie not only theoretical knowledge, but practical activity as well, and since it seeks to determine the interrelation of these subjective

and objective conditions, it is the empirical discipline the results of which are most immediately useful in the investigation of the general problems of the *theory of knowledge* and *ethics*, the two foundations of *philosophy*. Thus, psychology is, in relation to the natural sciences, the *supplementary science*; in relation to the mental sciences it is the *fundamental science*; and in relation to philosophy it is the *propaedeutic empirical science*.

10a. The following tabular summary presents in their systematic relation, the chief forms of psychology above described (1—3).

A. Psychology

I. METAPHYSICAL PSYCHOLOGY. Soul

- Spiritualistic psychology.
  - Dualistic psychology. mind dif. from matter
  - Monastic psychology. (Monadological systems) rel. to matter
- Materialistic psychology. neutral
  - Mechanical materialism. particles of brain
  - Psycho-physical materialism. correlation [illegible] sensation

[illegible]

II EMPIRICAL PSYCHOLOGY.

- Psychology of inner sense. (Pure introspection)
- Psychology as science of immediate experience. (Experimental and Social psychology).

b

- Descriptive psychology. (Faculty-psychology) classification
- Explanatory psychology. [illegible]
  - Intellectualistic psychology. objects ideas
    - Logical psychology. judgment & reasoning
    - Association psychology. [illegible]
  - Voluntaristic psychology. [illegible]

In their historical development many of these forms of psychology have grown up together. One may, however, mark off certain general sequences. Thus, metaphysical forms have generally preceded empirical forms; descriptive forms have preceded explanatory; and finally, intellectualism has preceded voluntarism. The oldest work which treated of psychology as an independent science was Aristotle's work entitled "On the Soul". This work is to be classified as belonging to the dualistic group in its metaphysics, and to the group of faculty-psychologies on the side of its empirical explanations. (The soul was treated as the living principle in the body. There were three fundamental faculties, namely, alimentation, sensation, and thought.) Modern spiritualistic psychology begins with Descartes' dualism which recognizes two distinct forms of reality, first, the soul as a thinking and unextended entity, and second, matter as an extended and nonthinking reality. The Cartesian system found the point of contact between these two forms of reality in a particular region of the human brain, namely, the pineal gland. The founder of modern materialism is Thomas Hobbes (1588—1679). (The ancient materialistic dualism of Democrates had not yet differentiated itself from spiritualistic dualism). Hobbes, together with La Mettrie and Holbach, developed in the 18th century a mechanical materialism, while Diderot and Helvetius developed a psycho-physical materialism which has representatives even in present times. Spiritualistic monism first arose in the monadology of Leibniz. In modern times this has been taken up by Herbart and his school, by Lotze, and others. The establishment of the psychology of the inner sense may be properly attributed to John Locke (1632—1704). This form of psychology has been defended in modern times, to some extent by Kant, and with special emphasis by Eduard Beneke (1798—1854), K. Fortlage, and others. Modern faculty-psychology arose with the work of Christian Wolff (1679—1754), who distinguished as the chief faculties, knowledge and desire. Since the time of Tetens (1736—1805) three faculties have been more commonly accepted than Wolff's two. Plato named these three, as did also Kant. They are knowledge, feeling and desire. Logical intellectualism is the oldest of the explanatory forms of psychology. This corresponds directly to the popular interpretation of psychical processes. The earlier empiricists, as for example, Locke, and even Berkeley (1648—1753) who in his "Essay towards a New Theory of Vision" anticipates modern experimental psychology, are to be classed as representatives of logical intellectualism. This view is at the present time to be found in the psychological discussions indulged in by physiological writers, when, for example, they treat of sense perception. Among the philosophical representatives of this logical intellectualism in our day, one must mention especially FRANZ BRENTANO and his school. Association psychology is first found in the works of two writers who appear at about the same time, namely, DAVID HARTLEY (1704—1757) and DAVID HUME (1711—1776). These two writers represent, however, two different tendencies which continue even in present-day psychology. HARTLEY's association psychology refers the association processes to certain physiological conditions, while HUME's regards the association process as a psychological process. The first form allies itself, accordingly, to psycho-physical materialism, this is found in the works of such a modern writer as HERBERT SPENCER. Closely related to HUME's psychological associationism is the psychology of HERBART. HERBART's doctrine of the statics and mechanics of ideas is a purely intellectualistic doctrine. (Feeling and volition are here recognized only as certain phases of ideas). It is in agreement with associationism in its fundamental mechanical view of mental life. This similarity is not to be overlooked merely because Herbart sought through certain hypothetical assumptions to give his psychological discussions an exact mathematical form. There are many anticipations of voluntaristic psychology in the works of psychologists of the "pure introspection" school, and of the association schools. The first thoroughgoing exposition of this form of psychology was the work of the author of this *Outlines of Psychology* in his psychological treatises. It is to be noted that this psychological voluntarism, as, indeed, one can see from the description which has already been given, is to be clearly distinguished from metaphysical voluntarism as developed by such a writer as SCHOPENHAUER. Metaphysical voluntarism seeks to reduce everything to an original transcendental will, which lies back of the phenomenal world as its substratum. Psychological voluntarism, on the other hand, looks upon empirical volitional processes, with their constituent feelings, sensations, and ideas, as the types of all conscious processes. For such a voluntarism even volition is a complex phenomenon which owes its typical significance to this very fact that it includes in itself the different kinds of psychical elements.

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§ 3. METHODS OF PSYCHOLOGY.

1. Since psychology has for its object, not specific contents of experience, but *general experience in its immediate character*, it can make use of no methods except such as the empirical sciences in general employ for the determination, analysis, and causal interpretation of facts. The fact that natural science abstracts from the subject, while psychology does not, can be no ground for modifications in the essential character of the methods employed in the two fields, though this fact does modify the way in which the methods are applied.

The natural sciences, which may serve as an example for psychology in this respect, since they were developed earlier, make use of *two* chief methods, namely, *experiment* and *observation*. *Experiment* is observation under the condition of purposive control by the observer, of the rise and course of the phenomena observed. *Observation*, in the narrower sense of the term, is the investigation of phenomena without such control, the occurrences being accepted just as they are naturally presented to the observer in the course of experience. Wherever experiment is possible, it is always used in the natural sciences; for under all circumstances, even when the phenomena in themselves present the conditions for sufficiently exact observation, it is an advantage to be able to control at will the rise and progress of these phenomena, or to isolate the various components of a composite phenomenon. Yet, even in the natural sciences the two methods have been distinguished according to their spheres of application. It is held that the experimental methods are indispensable for certain problems, while in others the desired end may not infrequently be reached through mere observation. If we neglect a few exceptional cases due to special relations,

processes

objects

Psy-uses experiments

these two classes of problems correspond to the general division of natural phenomena into *processes* and *objects*.

Experimental control is required in the exact determination of the course, and in the analysis of the components, of any *natural process*, such for example, as light vibration, sound vibration, an electric discharge, or the contraction of a muscle. As a rule such control is desirable because exact observation is possible only when the observer can determine the moment at which the process shall commence. It is also indispensable in separating the various components of a complex phenomenon from one another. As a rule, this is possible only through the addition or substraction of certain conditions, or through a quantitative variation of them. The case is different with *objects of nature*. They are relatively constant and are always at the observer's disposal and ready for examination. Here, then, experimental investigation is really necessary only when the production and modification of the objects are the subjects to be investigated. When, on the contrary, the only question is the actual nature of these objects, mere observation is generally enough. Thus, mineralogy, botany, zoology, anatomy, and geography, are pure sciences of observation so long as they are kept free from the physical, chemical, and physiological problems which are, indeed, frequently brought into them, but which have to do with processes of nature, not with the objects in themselves.

2. If we apply these considerations to psychology, it is obvious at once, from the very nature of its subject-matter, that exact observation is here possible only in the form of *experimental* observation. The contents of this science are exclusively *processes*, not permanent objects. In order to investigate with exactness the rise and progress of these processes, their composition out of various components, and

the interrelations of these components, we must be able first of all to bring about their beginning at will, and we must also be able to vary the conditions at will. This is possible here, as in all cases, only through experiment, not through observation. Besides this general reason there is another reason which is peculiar to psychology, and does not apply at all to natural phenomena. In the case of the natural sciences we purposely abstract from the perceiving subject, and under circumstances, especially when favored by the phenomena, as in astronomy, mere observation may succeed in determining with adequate certainty the objective contents of the processes. Psychology, on the contrary, is debarred from this abstraction by its fundamental principles, and proper conditions for chance observation can appear only when the same objective components of immediate experience are frequently repeated in connection with the same subjective states. It is hardly to be expected, in view of the great complexity of psychical processes, that this will ever be the case. Such chance coincidence is especially improbable since the very *intention to observe*, which is a necessary condition of all observation, modifies essentially the rise and progress of psychical processes. The chief problem of psychology, however, is the exact investigation of the rise and progress of subjective processes, and it can readily be seen that in such investigations the intention to observe either essentially modifies the facts to be observed, or completely suppresses them, at least, if the observation is of the ordinary introspective type, unaided by experimental devices of any sort. If, on the other hand, we consider the experimental methods, we see that psychology is led, through the very nature of the origin of the processes with which it deals, to employ, just as do physics and physiology, the experimental mode of procedure A sensation arises in us under the most favorable conditions for observation when it is aroused by an external sense stimulus. The idea of an object is always produced originally by the more or less complicated cooperation of sense stimuli. If we wish to study the way in which an idea is formed, we can choose no method other than that of imitating this natural way in which an idea arises. In doing this, we have at the same time the great advantage of being able to modify the idea itself by changing at will the combination of the impressions that cooperate to form it, and of thus learning what influence each single condition exercises on the product. Memory images, it is true, can not be directly aroused through external sense impressions, but follow these impressions after a longer or shorter interval. Yet, it is obvious that the attributes even of memory images can be most accurately learned, not by waiting for their chance arrival, but by using such memory ideas as may be aroused in a systematic, experimental way, through immediately preceding impressions. The same is true of feelings and volitions; they will be presented in the form best adapted to exact investigation when those impressions are purposely produced which experience has shown to be regularly connected with affective and volitional reactions. There is, then, no fundamental psychical process to which experimental methods can not be applied, and therefore none in the investigation of which such methods are not logically required.

3. *Pure observation*, such as is possible in many departments of natural science, is, from the very character of psychical phenomena, impossible in *individual* psychology. The possibility of pure observation would be conceivable only under the condition that there existed permanent psychical objects, independent of our attention, similar to the relatively permanent objects of nature, which remain unchanged by our observation. There are, however, certain facts at the disposal of

psychology, which, although they are not real objects, nevertheless, have the character of psychical objects, inasmuch as they possess the attributes of relative permanence and independence of the observer, and are unapproachable by means of experiment in the common acceptance of the term. These facts are the *mental products* which have developed in the course of history, such as language, mythological ideas, and customs. The origin and development of these products depend in every case on general psychical conditions which may be inferred from the objective attributes of the products. All such mental products of a general character presuppose as their condition the existence of a mental *community* composed of many individuals, though, of course, their deepest sources are the psychical attributes of the individual. Because of this dependence on the community, in particular on the social community, the whole department of psychological investigation here involved is designated as *social psychology*, and is distinguished from individual psychology, or as it may be called because of its predominating method, *experimental* psychology. In the present stage of the science these two branches of psychology are generally taken up in different treatises, although they are not so much different departments as different *methods*. So-called social psychology corresponds to the method of pure observation, the objects of observation in this case being the mental products. The necessary connection of these products with social communities, which has given to social psychology its name, is due to the fact that the mental products of the individual are of too variable a character to be the subjects of objective observation. The phenomena gain the necessary degree of constancy only when they become collective.

Thus psychology has, like natural science, *two* exact methods: the experimental method, serving for the analysis of simpler psychical processes, and the observation of general mental products, serving for the investigation of the higher psychical processes and developments.

3a. The introduction of the experimental method into psychology was originally due to the modes of procedure in physiology, especially in the physiology of the sense-organs and the nervous system. For this reason experimental psychology is also commonly called "physiological psychology"; and works treating it under this title regularly contain those supplementary facts from the physiology of the nervous system and of the sense-organs, which require special discussion with a view to the interests of psychology, though in themselves these facts belong to physiology alone. "Physiological psychology" is, accordingly, an intermediate discipline which is, however, as the name indicates, primarily *psychology*, and is, apart from the supplementary physiological facts that it presents, just the same as "experimental psychology" in the sense above defined. The attempt sometimes made, to distinguish psychology proper from physiological psychology, by assigning to the first the psychological interpretation of inner experience, and to the second the derivation of this experience from physiological processes, is to be rejected as inadmissible. There is only *one* kind of causal explanation in psychology, and that is the derivation of more complex psychical processes from simpler ones. In this method of interpretation, physiological elements can be used only as supplementary aids, because of the relation between natural science and psychology as above defined (§ 2, 4).

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§ 4. GENERAL SURVEY OF THE SUBJECT.

1. The immediate contents of experience which constitute the subject-matter of psychology, are in all cases processes of a composite character. Sense perceptions of external objects, memories of such sense perceptions, feelings, emotions, and volitional acts, are not only continually united in the most various ways, but each of these processes is itself a more or less composite whole. The idea of an external body, for example, is made up of partial ideas of its parts. A tone may be ever so simple, but we localize it in some direction, thus bringing it into connection with the idea of external space which is highly composite. Every feeling is referred to some sensation that aroused the feeling, and every volition is referred to an object willed. In dealing with a complex fact of this kind, scientific investigation has *three* problems to be solved in succession. The *first* is the *analysis* of composite processes; the *second* is the *demonstration of the combinations* into which the elements discovered by analysis enter; the *third* is the *investigation of the laws* that are operative in the formation of such combinations.

2. The *second*, or synthetic, problem is made up of several partial problems. In the first place, the psychical elements unite to form composite *psychical compounds* which are separate and relatively independent of one another in the continual flow of psychical processes. One group of examples of such compounds is to be found in ideas, whether referred directly to external impressions or objects, or interpreted by us as memories of impressions and objects perceived before. Other examples are composite feelings, emotions, or volitions. Then again, these psychical compounds stand in the most various interconnections with one another. Thus,

ideas unite to form larger simultaneous ideational complexes or regular successions, while affective and volitional processes form a variety of combinations with one another and with ideational processes. In this way we have the *interconnection of psychical compounds* as a class of synthetical processes of the *second* order, consisting of a union between the simpler combinations that have arisen from the earlier combinations of elements into psychical compounds. The separate psychical interconnection of the second order unite in turn to form still more comprehensive combinations, which also show a certain regularity in the arrangement of their components. In this way, combinations of a *third* order arise, which we designate by the general name *psychical developments*. These may be divided into developments of different scope. Developments of a more limited sort are such as relate to a *single phase of mental activity*, for example, the development of the intellectual functions, of the will, or of the feelings, or of merely one special branch of these functions, such as the aesthetic or moral feelings. From a number of such partial series arises the *total development of a psychical personality*. Finally, since animals, and in a still higher degree human individuals, are in continual interrelation with their fellow beings, there arise above these individual forms, *general psychical developments*. These various branches of the study of psychical development are in part the psychological foundations of other sciences, such as the theory of knowledge, pedagogy, aesthetics, and ethics, and are, accordingly, treated more appropriately in connection with those subjects. In part they have become special psychological sciences, such a child-psychology, animal psychology and social psychology. We shall, therefore, in this treatise discuss only those results from the last mentioned departments which are of the most importance to general psychology.

3. The solution of the last and most general psychological problem, namely, the problem of discovering the *laws of psychical phenomena*, depends upon the investigation of all the combinations of different orders, the combination of elements into compounds, of compounds into interconnections, and of interconnections into developments. And as this investigation is the only means by which we can learn the actual composition of psychical processes, so also the only means of discovering the attributes of *psychical causality*, which finds expression in these processes, is in the investigation of the laws followed by the contents of experience and their components in their various combinations.

We have, accordingly, to consider in the following chapters:

1) Psychical Elements,
2) Psychical Compounds,
3) Interconnection of Psychical Compounds,
4) Psychical Developments,
5) Psychical Causality and its Laws.

I. PSYCHICAL ELEMENTS.

§ 5. CHIEF FORMS AND GENERAL ATTRIBUTES OF PSYCHICAL ELEMENTS.

1. All the contents of psychical experience are of a composite character. It follows, therefore, that *psychical elements*, or the absolutely simple and irreducible components of psychical phenomena are the products of analysis and abstraction. This abstraction is rendered possible by the fact that the elements are in reality united in different ways. If an element, a, is connected in one case with the elements $b, c, d \ldots$, and in another case with $b', c', d' \ldots$, it is possible to abstract it from all the other elements, because none of them is always united with it. If, for example, we hear a simple tone of a certain pitch and intensity, it may be located now in this direction, now in that, and may be heard at different times in connection with various other tones. But since the direction is not constant, or the accompanying tone in all cases the same, it is possible to abstract from these variable elements, and we have the single tone as a psychical element.

2. As a result of psychical analysis, we find that there are *psychical elements of two kinds*, corresponding to the *two factors* contained in immediate experience (§ 1, 2), namely, to the objective contents of experience and to the experiencing subject. The elements of the objective contents we call *sensational elements*, or simply *sensations*: such are

a tone, or a particular sensation of heat, cold, or light, if in each case we neglect for the moment all the connections of these sensations with others, and also all their spacial and temporal relations. The subjective elements, on the other hand, are designated as *affective elements*, or *simple feelings.* We may mention as examples, the feelings accompanying sensations of light, sound, taste, smell, heat, cold, or pain, the feelings aroused by the sight of an agreeable or disagreeable object, and the feelings arising in a state of attention or at the moment of a volitional act. Such simple feelings are in a double sense products of abstraction: every such feeling is connected in reality with an ideational element, and is furthermore a component of a psychical process which occurs in time, during which the feeling itself is continually changing.

3. The actual contents of psychical experience always consist of various combinations of sensational and affective elements, so that the specific character of a given psychical process depends for the most part, not on the nature of its elements, so much as on their union into a composite psychical compound. Thus, the idea of an extended body or of a rhythm, an emotion, and a volition, are all *specific* forms of psychical experience. But their character as such is as little determined by their sensational and affective elements as are the chemical properties of a compound body by the properties of its chemical elements. *Specific* character and *elementary* nature of psychical processes are, accordingly, two entirely different concepts. Every psychical element is a specific content of experience, but not every specific content is at the same time a psychical element. Thus, spacial and temporal ideas, emotions, and volitional acts, are specific, but not elementary processes.

but a
part of

4. Sensations and simple feelings exhibit certain common

attributes and also certain characteristic differences. They have in common *two determinants*, namely, *quality* and *intensity*. Every simple sensation and every simple feeling has a definite *qualitative* character that marks it off from all other sensations and feelings; and this quality must always have some degree of *intensity*. Our *designations* of psychical elements are based entirely upon their qualities; thus, we distinguish such sensations as blue, grey, yellow, warmth and cold, or such feelings as grave, cheerful, sad, gloomy, and sorrowful. On the other hand, we always express the differences in the intensity of psychical elements by the same quantitative designations, as weak, strong, medium strong, and very strong. These expressions are in both cases class-concepts which serve for a first superficial arrangement of the elements, and each expression embraces an unlimitedly large number of concrete elements. Language has developed a relatively complete stock of names for the qualities of simple sensations, especially for colors and tones. Names for the qualities of feelings and for degrees of intensity are far behind in number and precision. Certain attributes other than quality and intensity, such as distinctness and indistinctness, are sometimes classed with quality and intensity as fundamental attributes. But since clearness, obscurity, etc., as will appear later (§ 15, 4), always arise from the interconnection of psychical compounds, they can not be regarded as determinants of psychical elements.

5. Made up, as it is, of the *two* determinants, quality and intensity, every psychical element must have a certain *degree of intensity* from which it is possible to pass, by continual gradations, to every other degree of intensity in the same quality. Such gradations can be made in only *two* directions: one we call *increase* in intensity, the other *decrease*. The degrees of intensity of every qualitative element, form

in this way a single dimension, in which, from a given point, we may move in two opposite directions, just as from any point in a straight line. This fact in regard to intensity may be expressed in the general statement: *The various intensities of every psychical element form a continuity of one dimension.* The extremities of such a continuity we call the *minimal* and *maximal sensations*, or the *minimal* or *maximal feelings*, as the case may be.

In contrast with this uniformity in intensities, *qualities* have more variable attributes. Every quality may, indeed, be assigned a place in a definite continuity of similar qualities in such a way that it is possible to pass uninterruptedly from a given point in this continuous series to any other point. But the various continuities of different qualities, which we may call *systems of quality*, exhibit differences both in the variety of possible gradations, and in the number of directions of gradation. With reference to these two kinds of variations in systems of quality, we may distinguish, on the one hand, *homogeneous* and *complex* systems, and on the other hand, *one-dimensional*, *two-dimensional*, and *many-dimensional* systems of quality. Within a homogeneous system, only such small differences are possible, that generally there has never arisen any practical need of distinguishing them by different names. Thus, we distinguish only *one* quality of pressure, of heat, of cold, or of pain, only *one* feeling of pleasure or of excitement, although, in intensity, each of these qualities may have many different grades. It is not to be inferred from this fact that in each of these systems there is really only *one* quality. The truth is that in these cases the number of different qualities is merely very limited; if we were to represent the system geometrically, we should probably never reduce it to a *single* point. Thus, for example, sensations of pressure from different regions of the skin show, beyond question, small qualitative differences which are great enough to make it possible for us to distinguish clearly any point of the skin from others at some distance from it. Such differences, however, as arise from contact with a sharp or dull point, or from a rough or smooth body, are not to be regarded as different qualities. They always depend on a large number of simultaneous sensations, and without the various combinations of these sensations into composite psychical compounds, the impressions mentioned would be impossible.

Complex systems of quality differ from those we have been discussing, in that they embrace a large number of clearly distinguishable elements between which all possible intermediate forms exist. In this class we must include the tonal system and color system, the systems of smells and tastes; and among the complex feeling systems we must include those which form the subjective complements of these sensational systems, such as the systems of tonal feelings, color feelings, etc. It is probable also that many systems of feelings belongs here, which are objectively connected with composite impressions, but are as feelings, simple in character; such are the various feelings of harmony or discord which correspond to various combinations of tones. The differences in the *number of dimensions* have been determined with certainty only in the case of two or three sensational systems. Thus, the tonal system is one-dimensional. The ordinary color system, which includes the colors and their transitional qualities to white, is two-dimensional; while the complete system of light sensations, which includes also the dark color-tones and the transitional qualities to black, is three-dimensional.

6. In regard to the relations discussed thus far, sensational elements and affective elements agree in general. They

feeling

differ, on the other hand, in certain essential attributes which are connected with the fact that sensations are immediately related to objects, while feelings are immediately related to the subject.

1) When varied in a single dimension, sensational elements exhibit *pure qualitative differences*, which are always in the *same direction* until they reach the possible limits of variation, where they become *maximal differences*. Thus, in the color system, red and green, blue and yellow, or in the tonal system, the lowest and highest audible tones, are the maximal differences and are at the same time purely qualitative differences. Every affective element, on the contrary, when continuously varied in the proper direction of quality, passes gradually into a feeling of *opposite quality*. This is most obvious in the case of those affective elements which are regularly connected with certain sensational elements, as for example, tonal feelings or color feelings. As sensations, a high and low tone present differences that approach more or less the maximal differences of tonal sensation; the corresponding tonal feelings are opposites. In general, then, *series of sensational qualities are bounded at their extremes by maximal differences; series of affective qualities are bounded by maximal opposites*. Between affective opposites is a middle zone, where the feeling is not noticeable at all. It is, however, frequently impossible to demonstrate this indifference-zone, because, while certain simple feelings disappear, other affective qualities remain, or new ones may arise. The latter case appears most commonly when the passing of the feeling into the indifference-zone depends on a change in sensations. Thus, in the middle of the musical scale, those feelings disappear which correspond to the high and low tones, but the middle tones have independent affective qualities of their own which appear clearly only when the other

complicating factors are eliminated. This is to be explained by the fact that a feeling which corresponds to a certain sensational quality is, as a rule, a component of a complex affective system, in which it belongs at the same time to various dimensions. Thus, the affective quality of a tone of given pitch belongs not only to the dimension of pitch feelings, but also to that of feelings of intensity, and finally to the different dimensions in which the clang character of tones may be arranged. A tone of middle pitch and intensity may, in this way, lie in the indifference-zone so far as feelings of pitch and intensity are concerned, and yet have a very marked clang feeling. The passage of affective elements through the indifference-zone can be directly observed only when care is taken to abstract from other accompanying affective elements. The cases most favorable for this observation are those in which the accompanying elements disappear entirely or almost entirely. Wherever such an indifference-zone appears without complication with other affective elements, we speak of the state as *free from feelings*, and of the sensations and ideas present in such a state, as *indifferent.*

2) Feelings which have specific, and at the same time simple and irreducible quality, appear not only as the subjective complements of simple sensations, but also as the characteristic attendants of composite ideas or even of complex ideational processes. Thus, there is a simple tonal feeling which varies with the pitch and intensity of tones, and there is also a feeling of harmony which, regarded as a feeling, is just as irreducible as the tonal feeling, but varies with the character of compound clangs. Still other feelings, which may in turn be of the most various kinds, arise from melodious series of clangs. Here, again, each single feeling taken by itself at a given moment, appears as an irreducible unit. Simple feelings are, then, much more various and numerous than simple sensations.

3) The various pure sensations may be arranged in a number of separate systems, between the elements of which there is no qualitative relation whatever. Sensations belonging to different systems are called *disparate.* Thus, a tone and a 1. color, a sensation of heat and one of pressure, or, in general, any two sensations between which there are no intermediate qualities, are disparate. According to this criterion, each of the four special senses (smell, taste, hearing, and sight) has a closed, complex sensational system, disparate from that of the other senses; while the general sense (touch) contains four homogeneous sensational systems (sensations of pressure, heat, cold, and pain). All simple feelings, on the other hand, form a single interconnected manifold, for there is no feeling from which it is not possible to pass to any other, through intermediate forms or through indifference-zones. But here too we may distinguish certain systems, the elements of which are more closely related, as, for example, feelings from colors, tones, harmonies and rhythms. These are, however, not absolutely closed systems, for there are everywhere relations either of likeness or of opposition to other systems. Thus, feelings such as those from sensations of moderate warmth, from tonal harmony, and from satisfied expectation, however great their qualitative differences may be, are all related in that they belong to the general class of "pleasurable feelings". Even closer relations exist between certain single affective systems, as for example, between tonal feelings and color feelings, where the feelings from deep tones seem to be related to those from dark colors, and feelings from bright colors to those from high tones. When in such cases a certain relationship is ascribed to the sensations themselves, it is probably due entirely to a confusion of the accompanying feelings with the sensations.

3. This third distinguishing characteristic shows conclusively

that the source of the feelings is *unitary* while that of the sensations, which depend on a number of different, and in part distinguishable, conditions, is not unitary. Probably this difference in the character of the sources of feeling and sensations is directly connected, on the one hand, with the relation of the feelings to the unitary subject, and, on the other hand, with the relation of sensations to the great variety of *objects*.

6a. It is only in modern psychology that the terms "sensation" and "feeling" have gained the meanings assigned to them in the definitions above given. In older psychological literature these terms were sometimes used indiscriminatingly, sometimes interchanged. Even yet sensations of touch and sensations from the internal organs are called feelings by physiologists, and the sense of touch itself is known as the "sense of feeling". This corresponds, it is true, to the original significance of the word, where feeling is the same as touching, and yet, after the differentiation has once been made, a confusion of the two terms should be avoided. Then again, the word "sensation" is used even by psychologists to mean not only simple, but also composite qualities, such as compound clangs and spacial and temporal ideas. But since we have the entirely adequate word "idea" for such compounds, it is more advantageous to limit the word sensation to sense qualities which are psychologically simple. Finally the term "sensation" has sometimes been restricted so as to mean only those impressions which come directly from external sense stimuli. For the psychological attributes of a sensation, however, this circumstance is entirely indifferent, and therefore, such a definition of the term is unjustifiable.

The discrimination between sensational elements and affective elements in any concrete case is very much facilitated by the existence of indifference-zones in the feelings. Then again it follows from the fact that feelings range between opposites rather than mere differences, that feelings are much the more variable elements of our immediate experience. This changeable character, which renders it almost impossible to hold an affective

limit sensation to sense quality

Sensations = [illegible]

state constant in quality and intensity, is the cause of the great difficulties that stand in the way of the exact investigation of feelings.

Sensations are present in all immediate experiences, but feelings may disappear in certain special cases, because of their oscillation through an indifference-zone. Obviously, then, we can, in the case of sensations, abstract from the accompanying feelings, but we can never abstract from sensations in the case of feelings. In this way two false views may easily arise, either that sensations are the *causes* of feelings, or that feelings are a particular species of sensations. The first of these opinions is false because affective elements can never be derived from sensations as such, but only from the attitude of the subject, so that under different subjective conditions the same sensation may be accompanied by different feelings. The second view, that feelings are a particular species of sensations, is untenable because the two classes of elements are distinguished, on the one hand by the immediate relation of sensations to objects and of feelings to the subject, and on the other hand, by the fact that the former range between maximal differences, the latter between maximal opposites. Because of the objective and subjective factors belonging to all psychical experience, sensations and feelings are to be looked upon as real and equally essential, though everywhere interrelated, elements of psychical phenomena. In the interrelation of the two groups of elements, the sensational elements appear as the more constant; they alone can be isolated through abstraction, by referring them to external objects. It follows, therefore, of necessity that in investigating the attributes of both kinds of elements, we must start with the sensations. Simple sensations, in the consideration of which we abstract from the accompanying affective elements, are called *pure sensations.*

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§ 6. PURE SENSATIONS.

1. The concept "pure sensation" as shown in § 5 is the product of a twofold abstraction: 1) from the ideas in which the sensation appears, and 2) from the simple feelings with which such a sensation is united. We find that pure sensations, defined in this way, form a number of disparate systems of quality; each of these systems, such as that of sensations of pressure, of tone, or of light, either is homogeneous or it is a complex continuity (§ 5, 5) from which no transition to any other system can be found.

2. The *rise of sensations*, as physiology teaches us, is regularly dependent on certain physical processes that have their origin partly in the external world surrounding us, partly in certain bodily organs. We designate these conditioning processes by a name borrowed from physiology, as *sense stimuli* or *sensation stimuli*. If the stimulus is a process in the outer world we call it a *physical stimulus*; if it is a process in our own body we call it a *physiological stimulus*. Physiological stimuli may be divided, in turn, into *peripheral* and *central*, according as they are processes in the various bodily organs outside of the brain, or processes in the brain itself. In many cases a sensation is attended by all three forms of stimuli. Thus, an external impression of light acts as a physical stimulus on the eye; in the eye and optic nerve there arises a peripheral physiological stimulation; finally a central physiological stimulation takes place in the corpora quadrigemina and in the occipital regions of the cerebral cortex, where the optic nerve terminates. In many cases the physical stimulus may be wanting, while both forms of physiological stimuli are present; as, when we perceive a flash of light in consequence of a violent ocular movement. In still other cases the central stimulus

alone is present; as, when we recall a light impression previously experienced. The central stimulus is, accordingly, the only one that always accompanies sensation. When a peripheral stimulus causes a sensation, it must be connected with a central stimulus, and when a physical stimulus causes a sensation it must be connected with both a peripheral and a central stimulus. Physiol: substrata of sensation systems

3. The physiological study of development renders it probable that the differentiation of the various sensational systems has been effected in part in the course of general development. The original organ of sense is the outer skin with the sensitive inner organs adjoining it. The organs of taste, smell, hearing, and sight, on the other hand, are later differentiations of the skin structure. It may, therefore, be surmised that the sensational systems corresponding to these special sense-organs, have also gradually arisen through differentiation from the sensational systems of the general sense, that is, from sensations of pressure, heat and cold. It is possible, too, that in lower animals some of the systems now so widely differentiated in human beings are more alike. From a physiological standpoint the primordial character of the general sense is also apparent in the fact that it has either very simple organs or none at all for the transfer of sense stimuli to the nerves. Pressure stimuli, temperature stimuli, and pain stimuli, can produce sensations at points in the skin where, in spite of the most careful investigation, no special end-organs can be found. There are, indeed, special receiving organs in the regions most sensitive to pressure (touch-corpuscles, end-bulbs, and corpuscles of Vater), but the structure of these organs renders it probable that they merely favor the mechanical transfer of the stimulus to the nerve-endings. Special end-organs for heat, cold, and pain have not been found at all.

In the special sense-organs which are of later origin we find, on the other hand, elaborate structures which not only effect the suitable transfer of the stimuli to the sensory nerves, but generally bring about a *physiological transformation* of the stimulation, which transformation seems to be indispensable for the rise of the particular sensational qualities. But even among the special senses there are differences in this respect.

The receiving organ in the *ear*, in particular, appears to be of a character different from that of the organs of smell, taste, and sight. In its most primitive forms the ear consists of a vesicle filled with one or more solid particles (otoliths), and supplied with nerve-bundles distributed in its walls. The solid particles are set in motion through sound vibrations, and must cause by their motion a rapid succession of weak pressure stimulations in the fibres of the nerve-bundles. The auditory organ of the higher animals shows an extraordinary complexity, but in its essential structure it recalls this primitive type. In the cochlea of man and the higher animals the auditory nerve passes at first through the axis, which is pierced by a large number of fine canals, and then emerges through the pores which open into the cavity of the cochlea. Here the branches are distributed on a tightly stretched membrane, which extends through the spiral windings of the cochlea and is weighted with special rigid arches (arches of Corti). This membrane — the basilar membrane, as it is called — must, according to the laws of acoustics, be thrown into sympathetic vibrations whenever sound waves strike the ear. It seems, therefore, to play the same part here as the otoliths do in the lower forms of the auditory organ. At the same time, one other change has taken place which accounts for the enormous differentiation of the sensational system. The basilar membrane has a different breath in its different parts, for it grows continually wider from the base to the apex of the cochlea. In this way it acts like a system of stretched cords of different lengths. And just as in such a system, other conditions remaining the same, the longer cords are tuned to lower, and the shorter to higher tones, so we may assume the same to be true for the different parts of the basilar membrane. We may surmise that the simplest auditory organs with their otoliths have a homogeneous sensational system, analogous perhaps to our system of sensations of pressure. The special development of the organ as seen in the cochlea of higher animals explains the evolution of an extraordinarily complex sensational system from this originally homogeneous system. In spite of all these changes the structure remains the same in this respect, that it seems adapted, in the latter case as in the former, to the best possible *transfer* of the physical stimulus to the sensory nerve rather than to any transformation of the stimulus. This view agrees with the observed fact that, just as sensations of pressure may be perceived on regions of the skin not supplied with special receiving organs, so, in the case of certain animals, such as birds, where the conditions are specially favorable for their transmission, sound vibrations are transferred to the auditory nerve and sensed even after the removal of the whole auditory organ with its special receiving structure.

With *smell*, *taste*, and *sight* the case is essentially different. Organs are present which render impossible direct action of the stimuli on the sensory nerves. The external stimuli are here received through special organs and modified before they excite the nerves. These organs are specially metamorphosed epithelial cells with one end exposed to the stimulus and the other passing into a nerve-fibre. Everything goes to show that the receiving organs here are not merely for the transfer of the stimuli, but are rather for the *trans-*

formation of the stimuli. In the three cases under discussion it is probable that the transformation is a *chemical* process. In smell and taste we have external chemical agencies, in sight we have light, as the causes of chemical disintegrations in the sensory cells. The processes in the cells then serve as the real stimuli.

These three senses may be distinguished as *chemical* senses, from the *mechanical* senses of pressure and sound. It is impossible to say with any degree of certainty, to which of these two classes sensations of cold and heat belong. One indication of the direct relation between stimuli and sensation in mechanical senses, as contrasted with the indirect relation in chemical senses, is that in the case of the mechanical senses, the sensation lasts only a very little longer than the external stimulus, while in the case of the chemical senses, the sensation persists very much longer. Thus, in a quick succession of pressures and more especially in a quick succession of sounds, it is possible to distinguish clearly the single stimuli from one another; lights, tastes and smells, on the other hand, run together even when given at a very moderate rate of succession.

Relation between sensation & stimuli

4. Since peripheral and central stimuli are regular physcal concomitants of elementary sensational processes, the attempt to determine the relation between stimuli and sensations is very natural. In attempting to determine this relation, physiology generally considers sensations as the result of physiological stimuli, but assumes at the same time that in this case any proper explanation of the effect from its cause is impossible, and that all that can be undertaken is to determine the constancy of the relations between particular stimuli and the resulting sensations. Now, it is found in many cases that different stimuli acting on the same end-organ produce the same sensations; thus, for example, mechanical and electrical stimulations of the eye produce light

Every sense organ is
fixed quality. diff. qual. are due to physiological elements

sensations. This result was generalized in the principle, that every receiving element of a sense-organ and every simple sensory nerve-fibre together with its central terminus, is capable of only a single sensation of fixed quality; that the various qualities of sensation are, therefore, due to the various physiological elements with their different specific energies.

This principle, generally called the "law of specific energy of nerves", is untenable for *three* reasons, even if we neglect for the moment the fact that it simply refers the causes of the various differences in sensations to a *qualitas occulta* of sensory and nervous elements.

1) It is contradictory to the physiological doctrine of the development of the senses. If, as we must assume according to this doctrine, the complex sensational systems are derived from systems originally simpler and more homogeneous, the physiological sensory elements must also have undergone a change. Such a change is, however, possible only under the condition that organs may be modified by the stimuli which act upon them. That is to say, the sensory organs determine the qualities of sensations only secondarily, as a result of the properties which they acquire through the processes of stimulation aroused in them. If, then, these sensory organs have undergone, in the course of time, radical changes due to the nature of the stimuli acting upon them, such changes could have been possible only under the condition that the physiological stimulations in the organs themselves varied to some extent with the quality of the stimulus.

2) The principle of specific energy is contradictory to the fact that in many senses there are no distinct sensory elements corresponding to the different sensational qualities. Thus, from a single point in the retina we can receive all possible sensations of brightness and color; in the organs of smell and taste, we find no clearly distinguishable forms of

the sensory elements, while even a limited area of the sensory surfaces in both these senses can receive a variety of sensations, which, especially in the case of the olfactory organ, is very large. Where we have every reason to assume that qualitatively different sensations actually do arise in different sensory elements, as in the auditory organ, the structure of the organ shows that this difference is not due to any attribute of the nerve-fibres or of other sensory elements, but that it comes originally from the way in which these elements are arranged. Different fibres of the auditory nerve will, of course, be stimulated by different tone-vibrations, because the different parts of the basilar membrane are tuned to different tones, but this is not due to some original and inexplicable attribute of the single auditory nerve-fibres. It is due to the way in which the single nerve-fibres are connected with the end-organ.

3) Finally, the sensory nerves and central elements can have no original specific energy, because the peripheral sense-organ must be exposed to the appropriate stimuli for a sufficient interval, or at least must have been so exposed at some previous period, before the corresponding sensations can arise through the excitation of the central organs. Persons congenitally blind and deaf do not have any sensations of light or tone whatever, so far as we know, even when the sensory nerves and centres were originally present.

Everything goes to show that the differences in the qualities of sensations are conditioned by the differences in the *processes of stimulation* that arise in the sense-organs. These processes are dependent primarily on the character of the *physical* stimuli, and only secondarily on the peculiarities of the receiving organ. And even then peculiarities are due to the adaptation of the sense-organs to the physical stimuli. As a result of this adaptation, however, it may come to be true

learned

that even when some stimulus other than that which has effected the original adaptation of the sensory elements, that is, when an inadequate stimulus acts, a sensation may arise which corresponds to the adequate stimulus. This does not hold, however, for all stimuli, or for all sensory elements. Thus, heat and cold stimulations can not cause cutaneous sensations of pressure or sensations in the special sense-organs; chemical and electrical stimuli produce sensations of light only when they act upon the retina, not when they act on the optic nerve; and, finally, mechanical and electrical stimuli can not arouse sensations of smell or taste. When an electric current causes chemical disintegration, it may, indeed, arouse such sensations, but it is through the adequate chemical stimuli produced.

5. From the very nature of the case, it is impossible to explain the character of sensations from the character of physical and physiological stimuli. Stimuli and sensations can not be compared with one another at all; the first belong to the mediate experience of the natural sciences, the second to the immediate experience of psychology. An interrelation between sensations and *physiological* stimuli must necessarily exist, however, in the sense that different kinds of stimulation always correspond to different sensations. This *principle of the parallelism of changes in sensation and in physiological stimulation* is an important supplementary principle in both the psychological and physiological doctrines of sensation. In psychology it is used in producing definite changes in the sensation, by means of intentional variation of the stimulus. In physiology it is used in inferring the identity or non-identity of physiological stimulations from the identity or non-identity of the sensations. Furthermore, the same principle is the basis of our practical life and of our theoretical knowledge of the external world.

6. Law of Parallelism of changes in sensat
of physiological stimulation

5a. The principle of "specific energy" appears as the implicit assumption in many of the earlier physiological discussions, but it remained for JOHANNES MÜLLER to give it a definite formulation. The principle was later employed, especially by HELMHOLTZ in his theories of hearing and vision. In the later expositions the form of the principle has been somewhat modified. As a rule the nerve fibres themselves are no longer considered as the seats of the specific energy; they are looked upon rather as indifferent conductors. It is the peripheral sensory elements (rods and cones of the retina, the endings of the auditory fibres in the cochlea etc.) or sometimes the nerve cells in the central sensory centres, or both of these, which are regarded as the seats of specific energy. Such views are, however, entirely hypothetical. Our knowledge of the processes in either the peripheral sensory cells, or in the central nerve cells, and even the greater part of our knowledge of the anatomy of these cells, is so very incomplete that we are not able to base any conclusions upon such knowledge. The only ground for the principle is, therefore, to be found in the phenomena, of like sensations arising from different stimuli, and these phenomena, as already remarked, do not give the principle any adequate ground for general acceptance. Indeed, in many cases the facts are capable of a very much simpler explanation on the basis of the conditions which surround the peripheral nerve endings. For example, the discrimination of the different tones in accordance with the law of sympathetic resonance, requires no reference to the principle of specific energy to show how each auditory fibre is affected by a particular sound wave, because the corresponding part of the basilar membrane is tuned to the particular sound wave in question. To be sure, the resonance hypothesis thus stated by HELMHOLTZ has been the subject of many attacks. No one has succeeded, however, in finding any hypothesis to replace it which agrees better with the laws of acoustics and with the structural relations in the organ of hearing.

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A. SENSATIONS OF THE GENERAL SENSE.

6. The definition of the "general sense" includes a spacial and a temporal factor. In point of time the general sense is that which precedes all others and therefore belongs to *all* beings endowed with mind. In point of spacial attributes, the general sense has the most extensive sensory surface exposed to stimuli. This surface includes not only the whole external skin and the adjoining areas of the mucous membrane, but also a large number of internal organs supplied with sensory nerves, such as joints, muscles, tendons, and bones, which are accessible to stimuli either regularly, or at least at certain times, and under special conditions, as is the case with bones.

The general sense includes *four* specific, distinct sensational systems: sensations of pressure, heat, cold, and pain. Not infrequently a single stimulus arouses more than one of these sensations. The sensation is then immediately recognized as made up of a mixture of components from the different systems. For example, we may have together sensations of pressure and pain, or sensations of heat and pain. In a similar manner, as a result of the extension of the sense-organ, we may often have mixtures of the various qualities of one and the same system, for example, we may have qualitatively different sensations of pressure, when an extended region of the skin is touched.

The four systems of general sense are all *homogeneous* systems (§ 5, 5). This shows that the sense is genetically earlier than the others, the systems of which are all *complex*. The sensations of pressure from the external skin, and those due to the tensions and movements of the muscles, joints, and tendons, are generally grouped together under the name *touch sensations*, and distinguished from the *common sensations*,

Sensation
1. Touch sensations
a. Internal touch sens
(1) joint sensation prod. by sens. of move
(2) muscle " " " " " tens
b. External touch

2. Common sensations

which include sensations of heat, cold and pain, and the sensations of pressure which sometimes arise in the other internal organs (stomach, intestines, lungs, etc.). *Touch sensations* may in turn be divided into *external touch sensations* and *internal touch sensations*. The first include the external skin impressions of pressure, the second, the impressions arising in the joints, muscles and tendons during movement. The internal touch sensations are again subdivided, with reference to the physiological organs from which they rise, as joint sensations and muscle sensations; with reference to the conditions which produce them, as sensations of movement or contraction, and as sensations of tension or effort.

tributes
ll. of
ilities
s. of organs
gen. sense

7. The ability of the different parts of the general sense-organ to receive stimulations and give rise to sensations, can be tested with adequate exactness only on the external skin. The only facts that can be determined in regard to the internal parts, are that the joints are in a high degree sensitive to pressures, while the muscles and tendons are much less so, and that sensations of heat, cold, and pain, in the internal organs are exceptional and rise to a noticeable intensity only under abnormal conditions. On the other hand, there is no point of the external skin, or of the immediately adjoining parts of the mucous membrane, which is not sensitive to stimulations of pressure, heat, cold and pain. The *degree* of sensitivity may, indeed, vary at different points, in such a way that the points most sensitive to pressure, to heat, and to cold, do not, in general, coincide. Sensitivity to pain is everywhere about the same, varying at most in such a way that in some places the pain stimulus acts on the surface, and in others not until it has penetrated deeper. On the other hand, certain regions of the skin appear to be most favorable for stimulations of pressure, heat and cold. These points are called respectively, pressure-

spots, heat-spots and cold-spots. They are distributed in different parts of the skin in varying numbers. Spots of different modality never coincide; yet, temperature-spots always receive sensations of pressure and pain as well; and a pointed hot stimulus applied to a cold-spot as a rule causes a sensation of heat, while heat-spots do not seem to be stimulated by pointed cold stimuli. Furthermore, heat-spots and cold-spots may give rise to their usual sensations in response to properly applied mechanical and electrical stimuli. It is to be noted also that the pressure-spots lie relatively near to each other. This, together with the fact that the skin itself tends to distribute any pressure stimulation, explains why it is that sensitivity for absolute pressures, and especially for pressure differences, when tested by weights of a limited area and of a somewhat diffuse character, is found to be nearly uniform for all parts of the skin, except in those areas which are covered with a very heavy layer of epidermis (soles of feet, etc.). The degree of this sensitivity is seen in the fact that one can distinguish clearly weights which differ in quantity by only $^1/_{12}$ of their intensity, and this ratio remains about constant for all such cases (Weber's Law § 17, 10).

four systems of general sense related

8. Of the four qualities mentioned, sensations of pressure and those of pain form closed systems which show no relations either to each other or to the two systems of temperature sensations. The temperature qualities, on the other hand, stand in the relation of *opposites*; we apprehend heat and cold, not merely as different, but also as *contrasted* sensations. It is, however, very probable that this is not due to the original nature of the sensations themselves, but partly to the conditions of their rise, and partly to the accompanying feelings. For, while the other qualities may be united without limitation to form mixed sensations — as, for example, pressure with

pain, cold with pain — heat, and cold exclude each other, because under the conditions of their rise, the only possibilities for a given cutaneous region are either a sensation of heat, or one of cold, or else an absence of both. When one of these sensations passes continuously into the other, the change regularly takes place in such a way, that either the sensation of heat gradually disappears and a continuously increasing sensation of cold arises, or conversely, the sensation of cold disappears and that of heat gradually arises. Then, too, elementary feelings of opposite character are connected with heat and cold, the point where both sensations are absent corresponding to their indifference-zone.

In still another respect the two systems of temperature sensations are peculiar. They are to a great extent dependent on the varying conditions under which the stimuli act upon the sense-organ. A considerable increase above the temperature of the skin is perceived as heat, while a considerable decrease below the temperature of the skin is perceived as cold. The temperature of the skin itself, which is thus the indifference-zone between the two forms of sensation can, within fairly wide limits, adapt itself rapidly to the existing external temperature. The fact that in this respect too, both systems are alike, favors the view that they are interconnected and also antagonistic.

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B. SENSATIONS OF SOUND.

9. We possess *two* independent systems of simple auditory sensations, which are, however, generally connected with each other as a result of the mixture of the two kinds of impressions. The two systems are, the *homogeneous* system of simple noise sensations, and the *complex* system of simple tone sensations.

Simple noise sensations can be produced only under conditions that exclude the simultaneous rise of tone sensations. Such conditions are presented, for example, when air vibrations are produced at a rate too rapid or too slow for tone sensations to arise, or when the sound waves act upon the ear for too short a period. Simple sensations of noise, thus produced, may vary in intensity and duration, but apart from these differences they appear to be qualitatively alike. It is possible that small qualitative differences exist among them, due to the conditions of their rise, but such differences are too small to be marked by distinguishing names. The noises, commonly so called, are compound ideas made up of such simple noise sensations and of a great many irregular tonal sensations (cf. § 9, 7). The homogeneous system of simple noise sensations is probably the first to develop. The auditory vesicles of the lower animals, with their simple otoliths, could hardly produce anything but simple noise sensations. In the case of a man and the higher animals it may be surmised that the structures found in the vestibule of the labyrinth receive only homogeneous stimulations, corresponding to simple sensations of noise. Finally, experiments with animals deprived of their labyrinths, make it probable that even direct stimulations of the auditory nerve can produce such sensations (p. 45). In the embryonic development of the higher animals, the cochlea develops from an original vestibular vesicle, which corresponds exactly to a primitive auditory organ. We are, therefore, justified in supposing that the complex system of tone sensations is a product of the differentiation of the homogeneous system of simple noise sensations, but that in every case where this development has taken place, the simple system has remained along with the higher.

10. The system of *simple tone sensations* is a continuity of one dimension. We call the quality of a single simple tone its *pitch*. The one-dimensional character of the system shows itself in the fact that, starting with a given pitch, we can vary the quality only in two opposite directions: change in one of these directions we call *raising* the pitch, change in the other we call *lowering* the pitch. In actual experience simple sensations of tone are never presented alone, but always united with other tone sensations and with accompanying simple sensations of noise. But since, according to the scheme given above (p. 32), these concomitant elements can be varied indefinitely, and since in many cases they are relatively weak in comparison with one of the tones, the abstraction of simple tones was early reached through the practical use of tone sensations in the art of music. The names *c*, *c*♯, *d*♯, and *d* stand for simple tones, though the clangs of musical instruments or of the human voice by means of which we produce these different pitches, are always accompanied by other, weaker tones, and often too, by noises. But since the conditions for the rise of such concomitant tones can be so varied that these concomitants become very weak, it has been possible to produce really simple tones of nearly perfect purity. The simplest means of doing this is by using a tuning-fork, and a resonator tuned to its fundamental tone. Since the resonator increases the intensity of the fundamental only, the other, accompany-

Components of the wave will set in vibration
her sections of the membrane, which corresp
n the same way to their pitch.

ing tones are so weak when the fork sounds, that the sensation is generally apprehended as simple and irreducible. If the sound vibrations corresponding to such a tone sensation are examined, they will be found to correspond to the simplest possible form of vibration, namely, to the so-called pendulum oscillation. This name is used because the vibrations of the atmospheric particles follow the same laws as a pendulum oscillating in a very small amplitude[1]. That these relatively simple sound vibrations correspond to sensations of simple tones, and that we can even distinguish the separate tones in compounds, can be explained according to the above-mentioned (p. 44) resonance hypothesis, from the structure of the organs in the cochlea, as an application of the law of sympathetic vibration. The basilar membrane in the cochlea is, in its different parts, tuned to tones of different pitch, so that when a simple oscillatory sound-vibration strikes the ear, only the part tuned to that particular pitch will vibrate in sympathy. If the same rate of oscillation comes in a compound sound-vibration, again only the part of the membrane tuned to that particular rate of vibration will be affected by it, while the other components of the wave will set in vibration other sections of the membrane, which correspond in the same way to their pitch. (Compare § 9, 7a.).

11. The system of tone sensations shows its character as a *continuous* series in the fact that it is always possible to pass from a given pitch to any other through continuous changes in sensation. Music has selected at option from this continuity, single sensations separated by considerable

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[1] Pendulum-oscillations may be represented by a *sine-curve* because the distance from the position of rest is always proportional to the sine of the time required to swing to the point in question.

intervals, thus substituting a *tonal scale* for the *tonal line.* This selection, however, is based on the relations of tone sensations themselves. We shall return to the discussion of these relations later, in taking up the ideational compounds arising from these sensations (§ 9). The natural tonal line has two extremities, which are conditioned by the physiological capacity of the ear for receiving sounds. These extremities are the *lowest* and *highest* tones; the former corresponds to 10—16 double vibrations per second, the latter to 30,000, 40,000 or even 50,000. The limit defined by these latter figures is, however, doubtful, since both the subjective recognition of intervals and the objective determination of the rate of vibration of the sounding body (tuning-fork or pipe) are very uncertain for these high pitches. For tones of medium pitch (from 200 to 1000 vibrations) we can distinguish differences in the pitch of tones which are given in succession, even when these tones differ only about one fifth of a vibration per second; and the difference thus necessary for discrimination remains in this part of the scale an absolute, fixed quantity, even though the pitch of the tone varies. Another fact which stands in full accord with that just described is the fact that if, depending entirely upon our recognition of tonal intervals, we bisect a certain tonal interval, say that which lies between the tones *a* and *c*, by determining upon a third tone, *b*, which shall stand half way between the two with which we began, then this third tone, *b*, will, in all cases, even when the interval is entirely unharmonious, lie in point of the number of its objective vibrations half way between *a* and *c*. In the case of very low tones, and much more in the case of very high tones, the sensitivity for qualitative differences becomes decidedly less and less. The sensitivity for *quantitative* differences of both tones and noises is also very deficient. Another fact also appears in this connection, which differentiates the sensitivity for quantitative differences from that which was found in the case of medium tonal qualities. Like the sensitivity of the skin for pressures (p. 53), the sensitivity for sound intensities is constant, not for absolute differences in intensity, but for relative differences only. The ratio of just noticeable differences between successive sound impressions is $^1/_3$ of the objective intensity of the original impression.

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C. SENSATIONS OF SMELL AND TASTE.

12. *Sensations of smell* form a complex system the arrangement of which is still unknown. All we know is that there are a great many different olfactory qualities, between which there are all possible transitional forms. There can, then, be no doubt that the system is a continuity of many dimensions.

12a. Olfactory qualities may be grouped in certain *classes*, each of which contains those sensations which are more or less related. This fact may be regarded as an indication of how these sensations may perhaps be reduced to a small number of principal qualities. Such classes are, for example, sensations like those from ether, balsam, musk, benzine, those known as aromatic, etc. It has been observed in a few cases that certain olfactory sensations which come from definite substances, can also be produced by mixing other substances. But these observations are still insufficient to reduce the great number of simple qualities contained in each of the classes mentioned, to a limited number of primary qualities and their mixtures. Finally, it has been observed that many odors neutralize each other, so far as the sensation is concerned, when they are mixed in the proper intensities. This is true not only of substances that neutralize each other chemically, as acetic acid and ammonia, but also of others, such as caoutchouc and wax or tolu-balsam, which do not act on each other chemically outside of the olfactory cells. Since this neutralization takes place when the two stimuli act on entirely different olfactory surfaces, one on the right and the other on the left mucous membrane of the nose, it is probable that we are dealing, not with phenomena analogous to those exhibited by complementary colors (22), but with a reciprocal central inhibition of sensations. Another observed fact tells against the notion that such neutralizing qualities are complementary. One and the same olfactory quality can neutralize several entirely different qualities, sometimes even those which in turn neutralize one another, while among colors it is always two fixed qualities, and only two, that are in each case complementary.

13. *Sensations of taste* have been somewhat more thoroughly investigated than those of smell, and we can here distinguish *four* distinct *primary qualities.* Between these primary qualities there are all possible transitional tastes, which are to be regarded as mixed sensations. The primary qualities are *sour*, *sweet*, *bitter*, and *saline.* Besides these, alkaline and metallic are sometimes regarded as independent qualities. But alkaline qualities show an unmistakable relationship to saline, and metallic to sour, so that both are probably mixed sensations (alkaline made up perhaps of saline and sweet, metallic of sour and saline). Sweet and

saline are opposite qualities. When these two sensations are united in proper intensities, the result is a *neutral* mixed sensation (commonly known as "insipid"), even though the stimuli that here reciprocally neutralize each other do not enter into a chemical combination. The system of taste sensations is, accordingly, in all probability to be regarded as a *two-dimensional* continuity, which may be geometrically represented by a circular surface on the circumference of which the four primary, and their intermediate, qualities are arranged, while the neutral mixed sensation is in the middle, and the other transitional taste qualities are on the surface, between this middle point and the saturated qualities on the circumference.

13a. In these attributes of taste qualities, we seem to have the fundamental type of a *chemical* sense. In this respect taste is perhaps the antecedent of sight. The obvious relation to the chemical nature of the stimulation, makes it probable even here that the reciprocal neutralization of certain sensations, with which the two-dimensional character of the sensational system is perhaps connected, depends, not on the sensations in themselves, but on the relations between the *physiological* stimulations, just as in the case of sensations of heat and cold (p. 54). It is well known that very commonly the chemical effect of certain substances can be neutralized through the action of certain other substances. We do not know what the chemical changes are which are produced by the gustatory stimuli in the taste-cells, but from the neutralization of sensations of sweet and saline we may conclude, in accordance with the principle of the parallelism of changes in sensation and in stimuli (p. 49), that the chemical reactions which sweet and saline substances produce in the sensory cells, also counteract each other. The same would hold for other sensations for which similar relations could be demonstrated. In regard to the physiological conditions for gustatory stimulations, we can draw only this *one* conclusion from the facts mentioned, namely the conclusion that the chemical le chemical processes of stimulation corresponding to the sensations which neutralize each other in this way, probably take place in the same cells. Of course, the possibility is not excluded that several different processes subject to neutralization through opposite reactions, could arise in the same cells. The known anatomical facts and the experiments of physiology in stimulating single papillae separately, give no certain conclusion in this matter. Whether we are here dealing with phenomena that are really analogous to those exhibited by complementary colors (v. inf. 22) is still an open question.

References. On smell: ZWAARDEMAKER, Physiologie des Geruchs, 1895. On taste, W. NAGEL, in Bibl. zool., 18, 1894, and in Pflüger's Archiv f. Physiol. vol. 54. OEHRWALL, Skand. Archiv f. Physiol. vol. 2. KIESOW, Philos. Studien vols. 9, 10, and 12.

D. SENSATIONS OF LIGHT.

14. The system of light sensations is made up of *two* partial systems: that of *sensations of achromatic light* and that of *sensations of chromatic light*. Between the qualities in these two systems, all possible transitional forms exist.

Sensations of achromatic light, when considered alone, form a system of *one* dimension, which extends, like the tonal line, between two limiting qualities. The sensations in the neighborhood of one of these limits we call *black*, those in the neighborhood of the other we call *white*, while between the two we insert *grey* in its different shades (dark grey, grey, and light grey). This one-dimensional system of achromatic sensations differs from that of tones in being *at once a system of quality and of intensity*; since every qualitative change in the direction from black to white is seen at the same time as an increase in intensity, and every qualitative change in the direction from white to black is seen as a decrease in intensity. Each point in the series, which thus has a definite quality and intensity, is called a degree of *brightness.* The whole system may, accordingly, be designated as that of *sensations of pure brightness.* The use of the the word "pure" indicates the absence of all sensations of color. The system of pure brightness is absolutely one-dimensional; both the variations in quality and those in intensity belong to one and the same dimension. This system differs essentially, in this respect, from the tonal line, in which each point is merely a degree of quality, and has by itself a whole series of gradations in intensity. Simple tone sensations thus form a two-dimensional continuity so soon as we take into account both determinants, quality and intensity, while the system of pure brightness is always *one-dimensional*, even when we attend to both determinants. The whole system may, therefore, be regarded as a continuous series of *grades of brightness*, in which the lower grades are designated black so far as quality is concerned, and weak so far as intensity is concerned, while the higher grades are called white and strong. Our sensitivity for differences in brightness is, especially for medium intensities, very great. The ratio is from $^1/_{100}$ to $^1/_{150}$ of the brightness with which we start in the comparison of two intensities. Like the ratios of pressure intensities and sound intensities (p. 59), this ratio of brightness intensities is constant in its relative magnitude. (WEBER's Law 17, 10.)

Chromatic

15. *Sensations of color* also form a one-dimensional system when their qualities alone are taken into account. Unlike the system of sensations of pure brightness, this system returns upon itself from whatever point we start, for at first, after leaving a given quality, we pass gradually to a quality that shows the greatest difference, and going still further we find that the qualitative differences become smaller again, until finally we reach the starting point once more. The color spectrum obtained by refracting sunlight through a prism,

or that found in the rainbow, shows this characteristic, though not completely. If in these cases we start from the red end of the spectrum, we come first to orange, then to yellow, yellow-green, green-blue, blue, indigo-blue, and finally to violet, which last is more like red than any of the other colors except orange, which lies next to red. The line of colors in the spectrum does not return quite to its starting-point, because it does not contain all of the colors that we have in sensation. Purple shades, which can be obtained by the objective mixture of red and violet rays, are wanting in the spectrum. Only when we fill out the spectrum series with purple, is the system of actual color sensations complete, and then the system is a closed circle. This characteristic of the color series is not to be attributed to the fact that we are accustomed to seeing the spectrum always arranged in this order. Even children who have never observed attentively a solar spectrum or a rainbow, and can, therefore, begin the series with any other color just as well as with red, always arrange the series in the same order when called on to arrange a promiscuous group of colored objects in the order of their subjective relations.

The system of pure colors is, accordingly, to be defined as one-dimensional. It does not extend in a straight line but *returns upon itself*. Its simplest geometrical representation would be a *circle*. From a given point in this system we pass, when the sensation is gradually varied, first to similar sensations, then to those most markedly different, and finally to others similar to the first quality, but lying on the opposite side. Every color must, accordingly, be related to *one maximum of difference* in sensation. This different sensation may be called the *opposite color*, and in the representation of the color system by a circle, two opposite colors are to be placed at the two extremities of the diameter. Thus, for example, purple and green, yellow and blue, light green and violet, are pairs of opposite colors, that is, colors which exhibit the greatest qualitative differences. Sensitivity for either absolute or relative objective color differences as expressed in the number of vibrations, is entirely irregular, changing constantly from point to point on the color line. Sensitivity is generally at its maximum in yellow and blue, at its minimum in red and violet. It has a third relatively low point between yellow and blue, that is, in green. A regularity such as is to be found in the case of tonal qualities (p. 58), or in the case of different degrees of brightness (p. 63), is entirely wanting here.

The quality determined by the position of a sensation in the color system, as distinguished from other qualitative determinations is called *color-tone*, a figurative term borrowed from tone sensations. In this sense the simple names of colors, such as red, orange, yellow, etc., denote merely color-tones. The color circle is a representation of the system of color-tones considered without reference to the other attributes belonging to the sensations. In reality, every color sensation has *two* other attributes, one we call *saturation* of the color, the other its *brightness*. Of these two attributes saturation is peculiar to chromatic or color sensations, while brightness belongs to both chromatic and achromatic sensations.

16. By *saturation* we mean the attribute of color sensations by virtue of which they appear in all possible stages of transition to sensations of pure brightness, so that a continuous passage is possible from every color to any point in the series of whites, greys, and blacks. The term "saturation" is borrowed from the common method of producing these transitional colors objectively, that is, by the saturation of some colorless soluble with color-pigment. Since the end of

every series of diminishing grades of saturation of any color quality is thus an achromatic sensation, the degree of saturation may be thought of as an attribute of all color sensations, and, at the same time, as the attribute by which the system of color sensations is directly united with the system of sensations of pure brightness. If, now, we represent some particular sensation of white, grey, or black by the central point of the color circle, all the grades of color saturation that can arise as transitional stages from any particular color to this particular sensation of pure brightness, will obviously be represented by that radius of the circle which connects the centre with the color in question. If the grades of color saturation corresponding to the continuous transitional stages from all the colors to a particular sensation of pure brightness, are thus geometrically represented, we have the system of saturation-grades as a *circular surface*, the circumference of which is the system of simple color-tones and the centre of which is the sensation of pure brightness, corresponding to the absence of all saturation. For the formation of such a system of saturation-grades any point whatever in the series of sensations of pure brightness may be chosen, so long as the condition is fulfilled that the white is not too bright, or the black too dark, for in such extreme cases differences in both saturation and color disappear. When such systems are made for all possible points, the system of saturation will be supplemented by that *of grades of brightness.*

17. *Brightness* is just as necessary an attribute of a color-sensation as it is of achromatic sensations, and is in the case of color sensations also, both a quality and a degree of intensity. Starting from a given grade, if the brightness increases, every color approaches white in quality, while at the same time the intensity increases; if the brightness de-

creases, the colors approach black in quality, and the intensity diminishes. The grades of brightness for any single color thus form a system of intensive qualities, analogous to the system of pure brightnesses, only in place of the achromatic gradations between white and black, we have the corresponding grades of saturation. From the point of greatest saturation there are *two* opposite directions for variation in saturation: one *positive*, towards white, accompanied by an increase in the intensity of the sensation, and the other *negative*, towards black, with a corresponding decrease in intensity. As limits for these two directions we have, on the one hand, the pure sensation white, on the other, the pure sensation black; the first is at the same time the maximum, the second the minimum of intensity. It follows obviously that there is a certain medium brightness for every color, at which its saturation is greatest. From this point, the saturation decreases in the positive direction, that is, towards white, when the brightness increases; and in the negative direction, that is, towards black when the brightness decreases. The grade of brightness most favorable for the saturation is not the same for all colors, but varies from red to blue, in such a way that it is most intense for red and least intense for blue. This accounts for the fact that in twilight, when the degree of brightness is small, the blue color-tones — of paintings, for example — are still clearly visible, while the red color-tones appear black (PURKINJE's phenomenon).

18. If we neglect for the moment the somewhat different relations of the maximal saturations of the various colors with respect to the line of brightness, we may represent the general relation which exists by virtue of the gradual transition of colors into white and black, that is, we may represent the general relation between *sensations* of *chromatic*

brightness and sensations of pure, or achromatic, brightness in the simplest manner by the following figure. First, we may represent the system of pure color-tones, that is, of the colors at their maximal saturation, by a circle, as above. Then we may draw through the centre of this circle, perpendicular to its plane, the straight line of pure brightness, in such a way that where it cuts the plane of the circular surface, it represents the sensation of pure brightness corresponding to the minimum of saturation of the colors with which we started. In like manner, the other color circles for increasing and decreasing grades of brightness, may be arranged at right angles along this line, above and below the circle of greatest saturation. But the decreasing saturation of the colors in these latter circles must also be expressed, and this can be done by the shortening of their radii; just as in the first circle, the shorter the distance from the centre, the less the saturation. The radii in successive circles grow continually shorter, until finally, at the two extremities of the line of brightness the circles disappear entirely. This corresponds to the fact that for every color the maximum of brightness passes into the sensation white, while its minimum passes into black 1).

19. The whole system of *sensations of chromatic brightness* may, accordingly, be most simply represented by a *spherical surface* the equator of which represents the system of pure color-tones, or colors of greatest saturation, while the two poles correspond to white and black, the extreme sensations of chromatic brightness. Of course, any other

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1) It must be observed, however, that the actual coincidence of these sensations can be empirically proved only for the minimum of brightness. Grades of brightness which approach the maximum are so injurious to the eye that the general demonstration of the approach to white must be accepted as sufficient.

geometrical figure with similar attributes, as, for example, two cones with a common base and with apexes pointing in different directions, would serve the same purpose. The only thing essential for the representation, is the gradual transition to white and black, and the corresponding decrease in the variety of the color-tones, which finds its expression in the continual decrease in the length of the radii of the color circles. Now, as above shown, the system of sensations corresponding to a particular sensation of pure brightness, may be represented by a circular surface which contains all the sensations of light belonging to one grade of brightness. When we unite grades of saturation and brightness into a single system, the *total system of all light sensations* may be represented by a *solid sphere.* The equator is the system of pure color-tones; the polar axis is the system of pure brightnesses; the surface represents the system of chromatic brightnesses, and finally, every circular plane at right angles to the polar axis, corresponds to a system of saturations of equal brightness. *The total system of light-sensations is, accordingly, a closed continuity of three dimensions. The three-dimensional* character of the system arises from the fact that every concrete sensation of light has *three* determinants: color-tone, saturation, and brightness. Pure, or achromatic, brightness on the one hand, and pure, or saturated colors, on the other hand, are to be regarded as the two extreme qualities in the series of saturations. The *closed* form of the system comes from the circular character of the color-line, and from the fact that the system of chromatic brightness terminates in the extremes of pure brightness. A special characteristic of the system is, that only the changes in *two* dimensions, namely, in color-tones and saturations, are pure changes in quality, while every movement in the *third* dimension, namely, in the direction of brightness, is at once a modification of both quality and intensity. As a consequence of this fact the whole three-dimensional system is required to represent fully the qualities of light sensations, though it includes also the intensities of these sensations.

20. Certain *principal sensations* are prominent in this system, because we use them as points of reference for the arrangement of all the others. These are *white* and *black*, in the achromatic series, and in the chromatic, the four principal colors: *red*, *yellow*, *green* and *blue*. This group of four colors was first pointed out as important by LEONARDO DA VINCI. Only these six sensations have clearly distinguished names in the early development of language. All other sensations are then named either with reference to these or even with modifications of the names themselves. Thus, we regard grey as a stage in the achromatic series lying between white and black. We designate the different grades of saturation according to their brightness, as whitish or blackish, light or dark color-tones; and we generally choose compound names for the colors between the four principal ones, as, for example, purple-red, orange-yellow, yellow-green, etc. These all show their relatively late origin by their very composition.

20a. From the early origin of the names for the six qualities mentioned, the conclusion has been drawn that they are *fundamental qualities* of vision, and that the others are compounded from them. Grey is declared to be a mixture of black and white, violet and purple to be mixtures of blue and red, etc. Psychologically there is no justification for calling any light sensations compound in comparison with others. Grey is a simple sensation just as much as white or black; such colors as orange and purple are just as much simple colors as red and yellow; and any grade of saturation which we have placed in the system between a pure color and white, is by no means, for that reason, a compound sensation. The closed, continuous character of the system makes it necessary for language to pick out certain especially marked differences in reference to which all other sensations are then arranged, for the simple reason that it is impossible to have an unlimited number of names. It is most natural that white and black should be chosen as such points of reference for the achromatic series, since they designate the greatest differences. When once these two are given, all other achromatic sensations will be considered as transitional sensations between them, since the extreme differences are connected by a series of all possible grades of brightness. The case of color sensations is similar; only here, on account of the circular form of the color line, it is impossible to choose directly two absolutely greatest differences. Other motives besides the necessary qualitative difference, are decisive in the choice of the principal colors. We may regard as such motives, the frequency and affective intensity of certain light impressions, due to the natural conditions of human existence. The red color of blood, the green of vegetation, the blue of the sky, and the yellow of the heavenly bodies in contrast with the blue of the sky, may well have furnished the earliest occasions for the choice of certain colors as those to receive names. Language generally names the sensation from the object that produced it, not the object from the sensation. In this case too, when certain principal qualities were once determined, all others must, on account of the continuity of the series of sensations, seem to be intermediate color-tones. The difference between principal colors and transitional colors is, therefore, very probably due entirely to external conditions. If these conditions had been other, red might have been regarded as a transitional color between purple and orange, just as orange is now placed between red and yellow[1]).

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[1]) The same false reasoning from the names of sensations, has even led to the assumption that the sensation blue developed later than other color sensations, because, for example, even in Homer the word for blue is the same as that for "dark" (L. GEIGER, Zur Entwicklungsgeschichte der Menschheit, 1871.). Tests of the color sensations of uncivilized peoples whose languages are much more deficient in names for colors than that of the Greeks at the time of Homer, have given us a superabundance of evidence that this assumption is utterly without ground (GRANT ALLEN, On Color, 1880.).

References. Purkinje, Beobachtungen und Versuche zur Physiologie der Sinne, 2 vols., 1819—1823. Helmholtz, Physiol. Optik, § 19—21. Hering, Zur Lehre vom Lichtsinn, 5 and 6, 1874—1878. (Hering holds to the view that the naming of the colors is due to their subjective characters and then proceeds to draw conclusions from this view for the theory of light sensations.) Wundt, Die Empfindung des Lichts und der Farben, Philos. Studien, vol. 4, also, Grundzüge der Phys. Psych., vol. I, chap. 9, § 4., also, Lectures on Hum. and Anim. Psych., lecture 6. (Figures 10—13 give the geometrical representations of the system of light sensations.) On sensitivity for color-differences: A. König and Dieterici, Archiv f. Ophthalm., vol. 30, no. 2. König, Zeitschr. f. Psychol. u. Phys. d. Sinnesorg., vol. 3. Mentz, Philos. Studien, vol. 13.

21. The attributes of the system of light sensations above described, are so peculiar that they lead us to expect a priori that the relation between these psychological attributes and the objective processes of stimulation, is essentially different from that which we inferred in the cases of the sensational systems discussed before, especially in the case of the general sense and auditory sense. Most striking in this respect, is the difference between the system of colors and that of tones. In the case of tones the principle of parallelism between sensation and stimulus (p. 49), holds, not only for the physiological processes of stimulation, but to a great extent for the physical processes as well. A simple sensation corresponds to a simple form of sound vibration, and a plurality of simple sensations corresponds to a compound form of vibration. Furthermore, the intensity of the sensation varies in proportion to the amplitude of the vibrations, and its quality varies with the form, so that in both directions the subjective difference between sensations increases with the growing difference between the objective physical stimuli. The relation in the case of light sensations is entirely different. Like objective sound, objective light also consists of vibrations of a certain medium. To be sure, the actual form of these

vibrations is still a question, but from physical experiments on the phenomena of interference we know that they consist of very short and rapid waves. Those seen as light vary in wave-length from 688 to 393 millionths of a millimetre, and in rate from 450 to 790 billion vibrations per second. For light, as for sound, simple sensations correspond to simple vibrations, that is, to vibrations of like wave-length; and the quality of the sensation varies continuously with the wave length and with the rate of vibration; thus, red corresponds to the longest and slowest waves, and violet to the shortest and most rapid, while the other color-tones form a series between these, varying with the changes in wave-length. Even here, however, an essential difference appears, for the colors red and violet, which are the most different in wave-length, are more similar in sensation than are most of the colors which lie between[1]. There are also other differences. 1) Every change in the amplitude of the physical vibrations corresponds, as we noted above in the discussion of sensations of brightness, to a subjective change in both intensity and quality. 2) All light, even though it be made up of all the different kinds of vibration, is simple in sensation, just as much as objectively simple light, which is made up of only one kind of waves. This is immediately apparent if we make a subjective comparison of sensations of chromatic light with those of achromatic light. From the first of these facts it follows that light which is physically simple may produce not only chromatic, but also achromatic sensations, for the sensation from such simple light approaches white when the amplitude of its vibrations increases, and black when the amplitude decreases. The quality of an achromatic sensation does not, therefore, determine unequivocally its source; such a sensation may be produced either through a change in the amplitude of objective light vibrations or through a mixture of simple vibrations of different wave-lengths. In the first case, however, there is always connected with the change in amplitude a change in the grade of brightness, which does not necessarily take place when a mixture is made.

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[1] Many physicists, to be sure, believe that an analogous relation is to be found between tones of different pitch, in the fact that every tone has in its octave a similar tone. But this similarity, as we shall see (§ 9), does not exist between simple tones, but depends on the actual sympathetic vibration of the octave in all compound clangs. Attempts to support this supposed analogy by finding in the color line intervals corresponding to the various tonal intervals, third, fourth, fifth, etc., have all been entirely futile.

22. Even when the grade of brightness remains constant, an achromatic sensation may have one of several sources. A sensation of pure brightness of a given intensity may result not only from a mixture of all the rates of vibration contained in solar light, as, for example, in ordinary daylight, but it may also result when only *two* kinds of light-waves are mixed in proper proportions. The kinds of light necessary to thus produce a sensation of pure brightness are those which correspond to sensations subjectively the most different, that is, to opposite colors, or at least to colors very nearly opposite in quality. Whenever the objective mixture of two colors produces white, these colors are called complementary colors. As examples of such complementary colors, we may mention spectral red and green-blue, orange and sky-blue, yellow and indigo-blue.

Each of the color sensations may, like achromatic sensations, though to more limited extent, have one of several sources. When two objective colors which lie nearer each other in the color-circle than opposites, are mixed, the mixture appears, not white, but of a color which in the series of objectively simple qualities lies between the two with which we started. The saturation of the resulting color is, indeed, very much diminished when the components of the mixture approach complementary colors; but when the component colors are near each other, the diminution in saturation is no longer perceptible, and the mixture and the corresponding simple color are generally subjectively alike. Thus the orange of the spectrum is absolutely indistinguishable from a mixture of red and yellow rays. In this way, all the colors in the color-circle between red and green can be obtained by mixing red and green, all between green and violet by mixing green and violet, and, finally, purple, which is not in the solar spectrum, can be produced by mixing red and violet. The whole series of color-tones possible in sensation can, accordingly, be obtained from the *three* objective colors, red, green and violet. By means of the same three colors we can also produce white with its intermediate stages. The mixture of red and violet gives purple, and this is the complementary color of green, and, finally, the white secured by mixing purple and green gives, when mixed in different proportions with the various colors, the different grades of saturation.

23. The three objective colors that may be used in this way to produce the whole system of light sensations, are called *fundamental colors*. In order to indicate their significance, a *triangular surface* is chosen to represent the system of saturations, rather than the circular surface which is derived from the psychological relations alone. The special significance of the fundamental colors is then expressed by placing them at the angles of the triangle. Along the sides are arranged the color-tones in their maximal saturation, just as on the circumference of the color circle, while on the triangular surface are the other grades of saturation in their transitions to white, the white lying, as in the circle, in the centre. Theoretically any set of three colors could be chosen

as fundamental colors, provided they were suitably distant from one another. Practically, those mentioned, namely, red, green and violet, are preferable because at the two ends of the spectrum sensations vary most slowly in proportion to the period of vibration, so that when the extreme colors of the spectrum are used as fundamental colors, the result obtained by mixing two neighboring ones is most like the intermediate, objectively simple color[1]).

24. These phenomena show that in the system of light sensations a simple relation does not exist between the physical stimuli and the sensations. This can be understood from what has been said above (3) as to the character of the *physiological* stimulation. The visual sense is to be reckoned among the *chemical* senses, and we can expect a simple relation only between the photochemical processes in the retina and the sensations. Now, we know from experience that different kinds of physical light produce like chemical disintegrations, and this explains in general the possibility mentioned above, of having the same sensation from many different kinds of objective light. According to the principle of parallelism between changes in sensation and in the physiological stimulation (p. 49), it may be assumed that the various physical stimuli which cause the same sensation, all produce the same photochemical stimulation in the retina, and that altogether there are just as many kinds and varieties of the photochemical processes as kinds and varieties of distin-

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[1]) In the neighborhood of green this advantage does not exist, and the mixtures always appear less saturated than the intermediate simple colors. This is a clear proof that the choice of the three fundamental colors mentioned is indeed the most practical, but nevertheless arbitrary, and at bottom due to the familiar geometrical principle that a triangle is the simplest figure that can enclose a finite number of points in the same plane.

guishable sensations. In fact, all that we know, up to the present time, about the physiological substratum of light sensations is based upon this assumption. The investigation of the physiological processes of light stimulation, has not yet given any further result than that the stimulation is in all probability a chemical process.

25. The relatively long *persistence of the sensation* after the stimulation that originated it, is explicable on the assumption that the light stimulations are due to chemical processes in the retina (p. 46). Such persistence of the sensation is called, with reference to the object used as stimulus, the *after-image* of the impression. At first this after-image appears in the same brightness and color as the object: white when the object is white, black when the object is black, and if the object is colored, the after-image appears in the same color. These are the positive and like-colored after-images. After a short time the after-image passes, in the case of achromatic impressions, into the opposite grade of brightness, white into black, or black into white; in the case of colors, it passes into the opposite or complementary color. These are the negative and complementary after-images. If light stimuli of short duration act upon the eye in darkness, this transition from positive to negative after-images may be repeated several times. A second positive after-image follows the negative, and so on, so that an oscillation between the two phases takes place. The positive after-image may be readily explained by the fact that the photochemical disintegration caused by any kind of light, lasts a short time after the action of the light. The negative and complementary after-images can be explained by the fact that disintegration in a given direction causes a partial consumption of the photochemical substance most directly concerned, and this results in a corresponding modi-

fication of the photochemical processes when the stimulation of the retina continues.

26. The phenomena of *color induction* and *light induction* are probably very closely related to positive and negative after-images. These phenomena consist in the appearance of simultaneous sensations of opposite brightness and color in the neighborhood of any light impression. *Positive* light induction is the less common of these two kinds of phenomena. It appears most noticeably in those cases in which one part of the retina is intensely stimulated and a contiguous region is left entirely unstimulated. In such a case the positive light stimulation, or color stimulation seems to spread out over the unstimulated area. In all other cases the opposite form of induction, namely, *negative* induction, appears. In consequence of such negative induction a white surface appears to be surrounded by a dark margin, a black surface by a bright margin, and a colored surface by a margin of the complementary color. These phenomena are, furthermore, accompanied by psychological contrast phenomena which belong under the general principle to be explained later (§ 17, 11), namely, the principle of emphasis of opposites. Indeed, the term "contrast" is, as a rule, applied to the total effects of such combined physiological and psychological influences. Such a use of the term is justified to a certain degree by the impossibility of separating the two kinds of influences from each other, but it would be much more appropriate to use the term *induced* excitation only for the physiological factor, and to reserve the term *contrast* for the psychological factor. For this psychological factor corresponds fully to the psychological emphasizing of opposites which can be demonstrated in other spheres, especially among spacial and temporal ideas, and among the feelings. Light induction and color induction, in this purely physiological sense, consist probably in a kind

of *negative* irradiation of the stimulation, in which the stimulation is not carried over directly to contiguous regions in its own proper quality as it is in the case of positive induction, but rather excites in these neighboring regions a stimulation process of opposite character. Such negative irradiation may possibly be due to the fact that the photochemical substances which are used up in the stimulation of a certain region of the retina, are replaced in part through an influx of other similiar substances from the surrounding regions. If, then, a light impression is applied to these impoverished neighboring regions, the result would be the same as that which would appear in the case of an after-image on the originally stimulated area (p. 77). Evidence in favor of assuming this connection between the facts of induction and after-images, appears in the fact that in both cases the effects are heightened by an increase in the intensity of the light impressions. But just at this point there shows itself a very fundamental difference between these physiological processes of light induction and the *psychological processes of contrast* with which they are usually erroneously classified. To this fundamental difference we shall return when we come to the general treatment of contrasts (§ 17, 10).

26a. If we take the principle of parallelism between sensation and physiological stimulation as the basis of our suppositions in regard to the processes that occur in the retina, we may conclude that the photochemical processes corresponding to chromatic and achromatic sensations, are relatively independent of each other, in a way analogous to that in which the corresponding sensations are relatively independent. *Two* facts, one belonging to the subjective sensational system, the other to the objective phenomena of color-mixing, can be very naturally explained on this basis. The first is the fact that every color sensation tends to pass into one of pure brightness as the grade of its brightness decreases or increases. This fact is most simply interpreted on the assumption that every color stimulation is made up of two physiological components, one corresponding to the chromatic, the other to the achromatic stimulation. To this assumption we must add the further condition, that for certain medium intensities of the stimuli the chromatic components are relatively the strongest, while for greater and smaller intensities the achromatic components predominate more and more. The second fact is, that there are complementary colors. This fact is most easily understood when we assume that opposite colors, which are subjectively the greatest possible differences in sensation, depend upon objective photochemical processes that neutralize each other. The fact that as a result of this neutralization an achromatic stimulation arises, is very readily explained by the presupposition that such an achromatic stimulation accompanies every chromatic stimulation from the first, and is, therefore, all that is left when antagonistic chromatic stimulations counteract each other. This assumption of a relative independence between the chromatic and achromatic photochemical processes, is supported by the existence of an abnormality of vision, sometimes congenital, sometimes acquired through pathological changes in the retina, namely *total color-blindness.* In such cases all stimulations are seen, either on the whole retina or on certain parts of it, as pure brightness, without any admixture of color. This is proof that the chromatic and achromatic stimulations are separable physiological processes.

1 fact

If we apply the principle of parallelism to the *chromatic stimulation*, *two* facts present themselves. The first is that two colors separated by a limited, short distance, when mixed give a color that is like the intermediate simple color. This indicates that color stimulation is a process which varies with the physical stimulus, not continuously, as the tonal stimulation, but in short stages, and in such a way that the stages in red and violet are longer than in green, where the mixture of colors fairly near each other, shows the effects of complementary action. The second fact is that certain colors which correspond to rather large differences in stimulation, namely, the complementary colors, evidently depend upon processes which neutralize each other. Now, let it be remembered that chemical processes can neutralize each other only when they are in some way opposite in character, and that for every color recognizable in sensation there is an opposite quality, it will then be seen that for every stage in the photochemical process of color stimulation there must be a stage of complementary action. Furthermore, since there are two opposite series of gradations through which these complementary effects may be reached, we are justified in drawing the conclusion that the return of the color circle to its beginning has its corresponding physiological fact in a return of the chemical processes to closely related forms. The whole series of chromatic stimulations, beginning with red and passing beyond violet through purple mixtures back to its first point, running parallel, as it does, with continuous changes in the wave-length of objective light, is to be regarded as an indefinitely long succession of photochemical disintegrations. All these processes together form a *closed circle* in which there is, for every stage, a neutralizing opposite, and in which there are two possible paths of transition in different directions to this neutralizing opposite.

We know nothing about the total number of photochemical stages in this circle of processes. The numerous attempts made to reduce all color sensations to the smallest possible number of such stages, lack adequate foundation. Sometimes they indiscriminatingly translate the results of physical color-mixing into physiological processes, as in the assumption of *three* fundamental colors, red, green, and violet, from the different mixtures of which all sensations of light, even the achromatic, are to be derived (YOUNG-HELMHOLTZ' hypothesis). Sometimes they start with the psychologically untenable assumption that the naming of colors is not due to the influence of certain external objects, but to the real significance of the sensations themselves (v. sup. p. 71), and assume accordingly *four* fundamental colors as the sources of all color sensations. The *four* fundamental colors here assumed are the two pairs red and green, yellow and blue, to which are added the similar pair of sensations of pure brightness, black and white. All other light sensations such as grey, orange, violet, etc., are regarded as subjectively and objectively mixed colors (HERING's hypothesis). The evidence in support of the first as of the second of these hypotheses has been derived for the most part from the not infrequent cases of *partial color-blindness*. Those who accept three fundamental colors, assert that all these cases are to be explained as a lack of the red or green sensations, or else as a lack of both. Those who accept four, hold that partial color-blindness always includes two fundamental colors which belong together as opposites, that color-blindness is, accordingly, either red-green-blindness or yellow-blue-blindness. An unprejudiced examination of color-blindness does not justify either of these assertions. The three-color theory can not explain total color-blindness, and the four-color theory is in contradiction to cases of pure red-blindness and pure green-blindness. Finally, both theories are overthrown by the cases that unquestionably occur, in which such parts of the spectrum as do not correspond to any of the three or four fundamental colors, appear colorless. The only thing that our present knowledge justifies us in saying, is that every simple sensation of light is probably conditioned by a combination of *two* photochemical processes, an *achromatic* and a *chromatic*. The first is made up, in turn, of a process mainly of disintegration when the light is more intense, and a process of restitution when the light is weaker. The chromatic process varies by stages in such a way that the whole series of photochemical color disintegrations forms a *circle of processes* in which the products of the disintegration for any two relatively most distant stages, neutralize each other[1]).

Various changes in the living retina have been observed as a result of the action of light, all of which go to support the assumption of a photochemical process. Such changes are, first, the gradual change into a colorless state, of a substance which in the retina not exposed to light is purple (bleaching of the visual purple); second, microscopical movements of the pigmented protoplasm between the sensitive elements, or rods and cones; and finally, changes in the form of the rods and cones themselves. Attempts to use these phenomena in any way for a physiological theory of light-stimulation, are certainly premature. The most probable conclusion which we can now draw is that the difference in the forms of the rods and cones is connected with a difference in function. The centre of the human retina, which is the region of direct vision, has only cones, while in the peripheral regions the rods predominate. In the centre (which, furthermore, has no visual purple) color differentiation is much more complete than in the peripheral regions. At the extreme outer limits of the retina color vision disappears entirely. The periphery is, on the other hand, more sensitive to brightness than the centre. It is probable that these differences in the function are related to the differences in the photochemical properties of the rods and cones, the cones being the chief organs of color vision, the rods being the chief organs for achromatic vision. This division of functions is, however, obviously not absolute.

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[1]) The further assumption is made by the defenders of the four fundamental colors, that two opposite colors are related just as bright and dark achromatic stimulations, that is, that one of these colors is due to a photochemical disintegration (dissimilation), the other to a restitution (assimilation). This is an analogy that contradicts the actual facts. The result obtained by mixing complementary colors is on its subjective side a *suppression* of the color sensation, while the mixture of white and black, on the other hand, produces the *intermediate* sensation, grey.

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[illegible]
experiencing subject
Obj. elements = sensations
Subj. " = simple feeling or affective elements

§ 7. SIMPLE FEELINGS.

1. Simple feelings may originate in very many more ways than simple sensations. For even such feelings as we never observe except in connection with more or less complex ideational processes, are often subjectively unanalyzable (p. 38). Thus, for example, the feeling of tonal harmony is just as simple as the feeling connected with a single tone. The only essential difference between the two is that the feelings which correspond to simple sensations can be easily isolated from the interconnections of which they form a part in our experience, by the same method of abstraction as that which we employed in discovering the simple sensations (p. 32). Those feelings, on the other hand, which are connected with some composite ideational compound, can never be separated from the feelings which enter into the compound as subjective complements of the sensation factors. Thus, for example, it is impossible to separate the feeling of harmony connected with the chord *c e g* from the simple feelings connected with each of the single tones *c*, *e*, and *g*. The latter may, indeed, be pushed into the background, for as we shall see later (§ 12, 3a), they always unite with the feeling of harmony to form a unitary *total feeling*, but they can never be eliminated.

2. The feeling connected with a simple sensation is commonly known as a *sense-feeling*, or as the *affective tone of a sensation*. These two expressions are capable of misinterpretation in opposite ways. There is a tendency to see in the term "sense-feeling" a reference, not merely to a component of immediate experience which may be isolated by abstraction, but more than that, reference to a component of such experience which may appear quite independently of other elements. The term "affective tone", on the other

hand, is looked upon as indicating that some affective quality is an invariable attribute of a sensation, just as "color-tone" is a necessary determinant of a color sensation. In reality, however, a sense-feeling without a sensation can no more exist than can a feeling of tonal harmony without tonal sensations. When, as is sometimes the case, the feelings accompanying sensations of pain, of pressure, of heat and of cold, and the feelings accompanying muscle sensations, are called independent sense-feelings, it is due to the confusion of the concepts sensation and feeling (p. 40) which is still prevalent, especially in physiology. As a result of this confusion certain sensations, such as those of touch, are called "feelings", and in the case of some sensations accompanied by strong feelings, as sensations of pain, the discrimination of the two elements is neglected. In the second place, it would be just as inadmissable to ascribe to a given sensation, as one of its attributes, a definite feeling fixed in quality and intensity. The real truth is that in every case the sensation is only *one* of the many factors that determine the feeling present at a given moment; besides the sensation, the processes that have gone before and the permanent dispositions — conditions that we can only partially account for in special cases — play an essential part. The concept "sense-feeling" or "affective tone" is, accordingly, in a double sense the product of analysis and abstraction: first, we must think of the simple feeling as separated from its concomitant pure sensation, and secondly, we must pick out from among all the various changing affective elements which are connected with a given sensation under different conditions, the one which is most constant and the one in the case of which all the influences that could disturb or complicate the simple effect of the sensation are as far as possible absent.

We must think of the simple feelings as separated from its concomitant pure sensation:

The first of these conditions is comparatively easy to meet, if we keep in mind the psychological meaning of the concepts sensation and feeling. The second is very difficult, and, especially in the case of the most highly developed sensational systems, that is, the auditory and visual systems, it is never really possible to remove entirely such *indirect* influences. Thus, for example, the sensation green arouses almost unavoidably the idea of green vegetation, and since there are connected with this idea composite feelings the character of which may be entirely independent of the affective tone of the color itself, it is impossible to determine directly whether the feeling observed when a green impression is presented, is a pure affective tone, a feeling aroused by the attending idea, or a combination of both.

2a. This difficulty has led many psychologists to argue against the existence of any pure affective tone whatever. They assert that every sensation arouses some accompanying ideas, and that the affective action of the sensation is due in every case to these ideas. But the results of experimental variation of the conditions for light sensations, tell against this view. If the attendant ideas were the only sources of the feeling, then the feeling would necessarily be strongest when the sensational contents of the impression were most like those of the ideas. This is by no means the case. The affective tone of a color is greatest when its grade of saturation reaches a maximum. The pure colors of the spectrum observed in surrounding darkness have the strongest affective tone. These colors are, however, generally very different from those of the natural objects to which accompanying ideas might refer. There is equally little justification for the attempts to derive tonal feelings exclusively from ideas. It can not be doubted that familiar musical ideas may be aroused through a single tone; still, on the other hand, the constancy with which certain tonal qualities are chosen to express particular feelings, as, for example, deep tones to express grave and sad feelings, can be understood only on the ground that the corresponding affective quality belongs to the simple tone sensation, rather than to a suggested idea. The circle in which the argument moves is still more obvious when the affective tones of sensations of taste, smell, and the general sense are referred to accompanying ideas. When, for example, the agreeable or disagreeable tone of a taste sensation is increased by the recollection of the same impression as experienced before, this can be possible only under the condition that the earlier impression was itself agreeable or disagreeable.

3. The varieties of simple sense-feelings are exceedingly numerous. The feelings corresponding to a particular sensational system form an affective system, since, in general, a change in the quality or intensity of the affective tone runs parallel with every change in the quality or intensity of the sensations. At the same time these changes in the affective systems are essentially different from the corresponding changes in the sensational systems. Thus, if the intensity of a sensation is varied, the affective tone may change not only in intensity, but also in quality; and if the quality of a sensation is varied, the affective tone may change not only in quality, but also in intensity. For example, increase the sensation sweet in intensity and it changes gradually from agreeable to disagreeable. Or, gradually substitute for a sweet sensation one of sour or bitter, keeping the intensity constant, it will be observed that, for equal intensities, sour, and more especially bitter, produce much stronger feelings than sweet. In general, then, *every change in sensation is usually accompanied by a twofold change in feeling.* The way in which changes in the quality and intensity of affective tones are related to each other follows the principle that every series of affective changes in *one* dimension ranges between *opposites*, not, as is the case with the corresponding sensational changes, between greatest differences (p. 37).

Every change in sensation is usually accompanied by a two-fold change in feeling

4. In accordance with this principle there correspond to the greatest qualitative differences in sensation, the greatest opposites in affective quality, and the maxima of affective intensities. These extremes are either equal, or at least, according to the special peculiarities of the qualitative opposites, approximately equal. The middle point between them corresponds, when only the single dimension to which the opposites belong is considered, to an absence of all intensity. This absence of intensity can be observed only when the corresponding sensational system is *absolutely one-dimensional*. In all other cases, a point which is a neutral middle for one particular series of sensational differences, belongs at the same time to another sensational dimension or even to a number of such dimensions, in each of which it has a definite affective value. Thus, for example, spectral yellow and blue are opposite colors which have correspondingly opposite affective tones. In passing gradually along the color line from one of these to the other, green would be the neutral middle between them. But green itself stands in affective contrast with its opposite color, purple; and, furthermore, it is, like every saturated color, one extremity of a series made up of the transitional stages of a single color-tone to white. Again, the system of simple tone sensations forms a continuity of only *one* dimension but in this case more than in others it is impossible to isolate the corresponding affective tones through abstraction, as we did the pure sensations, because in actual experience we always have, not only the tonal series to deal with, but also series of transitions between absolutely simple tones and noises which are made up of a profusion of simple tones. The result of these conditions is that every many-dimensional sensational system has a corresponding complex system of affective tones, in which every point generally belongs at once to several

dimensions, so that the neutral middle between opposite affective qualities can actually be found in experience only in the special cases where the affective tone of a particular sensation corresponds to the neutral middle of all the dimensions to which it belongs. This special condition is obviously fulfilled, at least approximately, for the many-dimensional sensational systems, especially those of sight and hearing, in just the cases in which it is of special practical value for the undisturbed occurrence of affective processes. For vision it is sensations of medium brightness, and those of the low grades of chromatic saturation approximating them, which form the neutral indifference-zones of affective quality; in the case of hearing it is the auditory impressions of our ordinary environment, which are between a tone and a noise in character (as, for example, the human voice). On both sides of these zones arise the more intense affective tones of the more marked sensational qualities.

5. The variations in affective quality and intensity that run parallel to the *different grades of sensational intensity*, are much simpler. They can be most clearly seen in the homogeneous sensational systems of the general sense. Each of these systems is of a uniform quality throughout, and is fairly well represented geometrically by a single point (p. 35), so that the only possible sensational changes are those of intensity, and these can be attended only by a one-dimensional series of affective changes between opposites. The neutral indifference-zone is, accordingly, always easy to observe in these cases. It corresponds to the medium sensations of pressure, heat and cold, which medium sensations are connected with the normal, medium intensity of ordinary sense-stimuli. The simple feelings on both sides of this zone exhibit decidedly opposite characters, and can usually be classified on one side as pleasurable feelings, on

the other as unpleasurable (v. inf. 7). The unpleasurable feelings are the only ones that can be produced with certainty, by increasing the intensity of the sensation. Through habituation to moderate stimuli, such an expansion of the indifference-zone has taken place in these systems of the general sense, that when the stimuli are weak, as a rule only a succession of sensations strikingly different in intensity or quality, can produce noticeable feelings. In such cases, feelings of pleasure always correspond to sensations of medium intensity.

The regular relation between sensational intensity and affective tone, can be better observed without this influence of contrast, in the case of certain sensations of smell and taste. At first a pleasurable feeling arises with weak sensations and increases with the increasing intensity of the sensations to a maximum, then the feeling sinks to zero with a certain medium sensational intensity, and finally, when this intensity increases still more, the feeling becomes unpleasurable and increases until the sensational maximum is reached.

6. The variety of simple affective qualities seems to be indefinitely great, at least it is greater than that of sensations. This is due to two facts. First, every sensation of the many-dimensional systems belongs at once to several series of feelings (p. 88). 1st Secondly, and this is the chief reason, 2nd the different compounds arising from the various combinations of sensations, such as intensive, spacial, and temporal ideas, and also certain stages in the course of emotions and volitions, have corresponding feelings, which are irreducible, and must therefore be classed among the simple feelings (p. 38).

It is greatly to be regretted that the names of simple feelings are so much more hazy than the names of sensations. The proper nomenclature of feeling is limited entirely to the

Every sensation belongs to several series of feelings
Special cpds. (as temporal, spacial ideas) have corresp
ings - not reducible - & classed among simple feel

expression of certain general antitheses, as agreeable and disagreeable, grave and gay, excited and quiet, etc. These designations are usually based on the emotions into which the feelings enter as elements, and they are, furthermore, so general that each includes a large number of single simple feelings of very different character. In other cases the names of complex ideas with affective characters similar to the feeling in question are used in describing the feelings connected with simple impressions, as, for example, by Goethe in his discription of the affective tone of colors, and by many writers on music in describing the feelings accompanying clangs. This poverty of language in special names for the feelings, is a psychological consequence of the subjective nature of the feelings. All the motives of practical life which give rise to the names of objects and their attributes, are here wanting. To infer from this poverty of language that there is a corresponding poverty of simple affective qualities themselves, is a psychological mistake, which is the more fatal since it renders an adequate investigation of the composite affective processes impossible from the first.

7. In consequence of the difficulties indicated, a complete list of simple affective qualities is out of the question, even more than is a complete list in the case of simple sensations. Then, too, there are still other reasons why it would be impossible to make such a list of feelings. The feelings, by virtue of the attributes described above, do not form separate systems, as do the sensations of tone, of light, or of taste, but all feelings are united in a single manifold, interconnected in all its parts (p. 36). In this manifold of feelings, it is however, possible to distinguish certain different *chief affective series, or dimensions*, terminating in affective opposites of predominant character. Such series, or dimensions may always be designated by the *two* names that indicate their

opposite extremes. Each name is, however, to be looked upon as a collective name including a great variety of feelings differing from one another in certain minor individual characteristics.

Three such chief dimensions may be distinguished. We call them the series of *pleasurable* and *unpleasurable feelings*, that of *arousing* and *subduing* (exciting and depressing) feelings, and finally that of feelings of *strain* and *relaxation*. Any concrete feeling may belong to all of these dimensions, or it may belong to only two, or even to only one of them. The last mentioned possibility is all that makes it possible to distinguish the different directions. The combination of different affective dimensions which ordinarily takes place, and the influences mentioned above (p. 38), and explained as due to the overlapping of feelings arising from various causes, all go to explain why we are perhaps never in a state entirely free from feeling, although the general nature of the feelings renders it theoretically certain that there is an indifference-zone.

8. Feelings connected with sensations of the general sense and with impressions of smell and taste, may be regarded as good examples of pure pleasurable and unpleasurable forms. A sensation of pain, for example, is regularly accompanied by an unpleasurable feeling without any admixture of other affective forms. In connection with pure sensations, arousing and subduing feelings may be observed best in the case of color impressions and clang impressions. Thus, red is arousing, blue subduing. Feelings of strain and relaxation are always connected with the processes of attention. Thus, when we expect a sense impression, we note a feeling of strain, and on the arrival of the expected event, we note a feeling of relaxation. Both the expectation and satisfaction may be accompanied at the same time by a feeling of excitement or, under special conditions, by pleasurable or un-

pleasurable feelings. These other feelings may, however, be entirely absent, and then the feelings of strain and relaxation are recognized as specific forms which can not be reduced to others, just as the other forms were recognized as distinct and separate in the examples mentioned before. The presence of more than one affective tendency may be discovered in the case of very many feelings which are, nevertheless, just as simple in quality, as the feelings mentioned. Thus, the feelings of seriousness and gaiety connected with the sensible impressions of low and high tones or dark and bright colors, are to be regarded as characteristic qualities which are outside the indifference-zone in both the pleasurable and unpleasurable dimension and the exciting and depressing dimension. We are never to forget here that pleasurable and unpleasurable, exciting and depressing, are not names of single affective qualities, but of dimensions or series, within which an indefinitely large number of simple qualities appear, so that the unpleasurable quality of seriousness is not only to be distinguished from that of a painful touch, of a discord, etc., but even the different cases of seriousness itself may vary in their quality. Again, the series of pleasurable and unpleasurable feelings, is united with that of feelings of strain and relaxation, in the case of the affective tones of rhythms. The regular succession of strain and relaxation in these cases is attended by pleasure, the disturbance of this regularity, by the opposite feeling, as when we are disappointed or surprised. Then, too, under certain circumstances the feeling of rhythm may be of either an exciting or a subduing character.

8a. Of the three affective dimensions mentioned, only that of pleasurable and unpleasurable feelings has generally been recognized; the others are usually treated as emotions. But the emotions, as we shall see in § 13, are combinations of feelings; it is obvious, therefore, that the fundamental forms of emotions must have their antecedents in the affective elements. Some psychologists have regarded pleasurable and unpleasurable feelings, not as collective terms including a great variety of simple feelings, but as entirely uniform, concrete states, so that, for example, the unpleasurableness of a toothache, of an intellectual failure, and of a tragical experience are regarded as identical in their affective contents. Still others seek to identify the feelings with special sensations, especially with cutaneous sensations or muscle sensations. Such theories are utterly helpless when confronted with the problems that arise in the study of complex emotions, as for example, throughout the sciences of aesthetics or ethics, or else they make shift to meet these problems by an intellectualistic mode of interpretation copied from the psychology of the unscientific man. In this latter case the aesthetic effects are entirely suppressed under certain logical reflections about such effects, and then the assertion is subsequently accepted that these logical reflections are themselves the aesthetical effects. It would be more within reason to think that the *six* classes of feelings which appeared in the classification of the chief affective tendencies, or dimensions (pleasure, unpleasantness, excitation and subduing feeling, strain and relaxation) are themselves simple, concrete qualities, capable of giving rise to qualitative differences in emotions through combinations in different proportions and in different intensities, and through such combinations only. Such a view of feeling as this, seems in fact to be supported by the testimony of those who are partially hypnotized and are, therefore, through the consequent concentration of consciousness (§ 18, 8) in a condition especially adapted to subjective analysis of the feelings (O. VOGT). It is possible, however, that the concentration of consciousness which favors this discrimination of the chief affective tendencies in hypnosis, hinders, after all, a complete analysis. At all events, the supposition that there are six uniform fundamental qualities is contradicted by the character and attributes of simple color feelings and tonal feelings. When, for example, one changes the deep sky blue of the spectrum at which he may be looking, into indigo-blue, he will feel in both cases the peculiar quieting effect of blue, but in the two cases there will be a different shade of this feeling which it would be very difficult to account for by assuming the admixture of any other feeling. It is still more difficult to give adequate explanations of the feelings which are connected with complex impressions, on the basis of this assumption that there are only three pairs of simple feelings. Thus such musical intervals as the third, fourth, and fifth are accompanied, each by feelings of pleasure which are not merely quantitatively different, but also qualitatively different. The lack of proper designations makes very difficult, to be sure, the accurate verbal discrimination of these finer shades of feeling, but this lack of terms can not be attributed to a lack of feelings, especially as in this case there are obvious grounds on which the lack of terms can be more fully understood. Indeed, one might draw upon the case of sensations for corroboration of this view in regard to the lack of terms for feelings. The names of sensations are very much more numerous than the names of feelings, because of the constant use of such names for objective designations, but even though this is true, yet the names of sensations are very far indeed from equaling in number the different qualities that are subjectively distinguished, especially in the cases of tones, lights, and colors.

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9. The question whether or not particular *physiological processes* correspond to the simple feelings is more difficult to answer than was the similar question in regard to the sensations. In looking for such processes, it follows from the subjective nature of the feelings, that we should not expect to find them, as in the case of sensations, among the

processes produced directly in the organism by external agents, we must look rather among the *reactions* which arise indirectly from these first processes. Further evidence pointing in the same direction is derived from observation of psychical compounds made up of affective elements, that is, from observation of emotions and volitions, the physiological concomitants of which are always external movement.

The analysis of sensations, and of the psychical compounds derived from them, makes direct use of the *impression method*; while the investigation of simple feelings, and of the processes resulting from their combinations, can employ this method only *indirectly*. On the other hand, the *expression method*, that is, the investigation of the physiological *reactions* of psychical processes, is especially adapted to the examination of feelings and processes made up of feelings. All the phenomena in which the inner state of the organism is outwardly expressed, may be utilized as aids in the expression method. Such are, besides the movements of the external muscles, especially the respiratory and cardiac movements, the contraction and dilation of the blood-vessels in particular organs, the dilation and contraction of the pupil of the eye, etc. The most delicate of these is the beating of the heart, which can be examined as exactly reproduced in the pulse of some peripheral artery. In addition to these pulse changes, the changes in the tension of the muscles of the small arteries (the so-called vaso-motor innervations) and the changes in the respiratory movements, are more or less characteristic symptoms. The mimetic movements appear clearly only when the feelings pass into emotions (§ 13, 4).

10. Of the chief dimensions of feeling mentioned above, especially the dimension of *pleasurable* and *unpleasurable* feelings can be shown to stand in regular relation to the pulse. When the feeling is pleasurable, the pulse is retarded

and intensified, when unpleasurable, the pulse is accelerated and weakened. Of the other forms of feeling, the *exciting* feelings show their presence through stronger pulse-beats, and *subduing* feelings through weaker pulse-beats, there being no apparent change of rate in either case. For feelings of *strain*, and for those of *relaxation* the changes seem to consist chiefly in temporary irregularities of the pulse, which may perhaps be connected with the inhibition of respiration accompanying strain, and with the acceleration of respiration accompanying relaxation. Single feelings belong for the most part to several of these dimensions at the same time; as a result the innervation symptoms are in many cases evidently complex in character. It is, accordingly, impossible to infer from these physiological processes what are the corresponding states of feeling in any special case, and this is all the more so because each of the innervation processes is, in addition to its own complexity, complicated by the presence of certain purely physiological processes such as the processes of metabolism and other processes going on in the lower nerve centres. Bodily activity can, then, at best do no more than indicate the preponderance of this or that affective tendency, and even these indications are not certain unless they are corroborated by direct observations of the feelings themselves.

10a. The investigation of the physiological symptoms of feelings needs to be made more complete in several directions. The pulse changes that accompany feelings of strain and relaxation are especially uncertain. We may accept as established the general fact that correspondence exists between certain affective opposites and similarly opposite physical symptoms, but we must also recognize that any single symptom may have a variety of meanings because of the large number of possible complications between the effects of different feelings. It follows directly from this fact that we can never infer forthwith from the physiological symptoms that certain particular feelings are present, and that there is no justification for recognizing the method of expression as of equal value for psychology with the method of impression. The method of impression is the only one which, from the nature of the case, can be employed in arousing mental processes at will, or in varying them in a similar manner.

The *physiological conditions* of cardiac, vaso-motor, and respiratory symptoms are, for the most part, still obscure. The cardiac innervations are the ones which have been most fully investigated. Physiology shows that the heart is connected with the central organs by two kinds of nerves: *excitatory nerves*, which run through the sympathetic system and originate indirectly in the medulla, and *inhibitory nerves*, which belong to the tenth cranial nerve (vagus) and also have their source in the medulla. The normal regularity of the pulse depends on a certain equilibrium between excitatory and inhibitory influences. Such influences come not only from the brain, but from the centres in the heart itself. Thus, every increase and every decrease of the heart's energy may be interpreted in two different ways. Increase may be due to an increase of excitatory, or to a decrease of inhibitory innervation, and decrease may be due to a decrease in excitatory or to an increase in inhibitory innervation, or in both cases the two influences may be united. We have no universally applicable means of investigating these possibilities, still, the fact that the stimulation of the inhibitory nerves has a quicker effect than the stimulation of the excitatory, gives us good ground in many cases for conjecturing the presence of the one or the other. The changes in the pulse always follow very quickly the sensations that cause them. It is, therefore, probable that in the case of feelings and emotions, we have chiefly changes in inhibitory innervation, originating in the brain and conducted along the vagus. It may well be assumed that the affective tone of sensation corresponds on its physiological side to a spreading of the stimulation from the sensory centre to those central regions which are connected with the sources of the inhibitory nerves of the heart. What central regions these are, we do not know. But the fact that the physiological substrata for all the elements of our psychological experience, are in all probability to be found in the cerebral cortex, leads very naturally to the assumption that the same is true of the centre of these inhibitory innervations. Furthermore, the essential differences between the attributes of feelings and those of sensations, make it probable that this centre is not identical with the sensory centres. If a special cortical region is assumed as the medium for these inhibition effects, there is no reason for supposing a special inhibitory region for each sensory centre. Indeed, the complete uniformity in the physiological symptoms goes more to show that there is only one such region, which must serve at the same time as a kind of central organ for the connection of the various sensory centres. (For further significance of such a central region, and its probable anatomical position, compare § 15, 2a.)

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II. PSYCHICAL COMPOUNDS.

§ 8. DEFINITION AND CLASSIFICATION OF PSYCHICAL COMPOUNDS.

1. By "psychical compound" we mean any composite component of our immediate experience which is marked off from other contents of this experience by characteristics peculiarly its own, in such a way that it is recognized as a relatively independent unity and is, when practical necessity demands it, designated by a special name. In developing such a name, language has followed the general rule that only *classes* and the most important *species* into which phenomena may be grouped shall have special designations. Thus such terms as idea, emotion, volitional act, etc., designate general classes of psychical compounds, such terms as visual idea, joy, anger, hope, etc., designate special species included in these classes. So far as these designations are based upon actual, distinguishing characteristics, they have a certain value for psychological analysis. But in granting this, we must avoid from the first, *two* presuppositions to which the existence of these names might easily mislead us. The first is, that a psychical compound is an absolutely independent content of immediate experience. The second is, that certain compounds, as for example, ideas, have the *nature of things*. The truth is that compounds are only *relatively* independent units. Just as they are made up of various

elements, so they themselves unite to form a complete interconnection, in which relatively simple compounds may continually combine to form more composite ones. Then, again, compounds, like the psychical elements contained in them, are never things, but *processes* which change from moment to moment, so that it is only through deliberate abstraction, which is, indeed, indispensable for the investigation in many cases, that they can be thought of as constant at any given moment (p. 32).

2. All psychical compounds may be resolved into psychical elements, that is, into pure sensations and simple feelings. The two kinds of elements behave, however, in an essentially different manner, in keeping with the special properties of simple feelings described in § 7. The sensational elements found by such a resolution, always belong to one of the sensational systems already considered. The affective elements, on the other hand, include not only those which correspond to the pure sensations contained in the compounds, but also those due to the interconnection of the elements into a compound. The systems of sensational qualities, accordingly, remain the same, no matter how many varieties of compounds arise, while the systems of simple affective qualities continually increase. Furthermore, it is a general principle valid for all psychical compounds, whether they are composed of sensations only, of feelings only, or of combinations of both sensations and feelings, that *the attributes of psychical compounds are never limited to those of the elements that enter into them.* It is true rather that *new* attributes, peculiar to the compounds themselves, always arise as a result of the combination of these elements. Thus, a visual idea has not only the attributes of the light sensations and sensations of ocular position and movements contained in it, but it has also the attribute of spacial arrangement

of the sensations, a factor not present in the elements themselves. Again a volition is made up not only of the ideas and feelings into which its single acts may be resolved, but there result also from the combination of these single acts, new affective elements which are specifically characteristic of the complex volition. Here, again, the combinations of sensational and affective elements are different. In the first case, on account of the constancy of the sensational systems, no new sensations can arise, but only peculiar *forms of their arrangement.* These forms are the *extensive spacial* and *temporal manifolds.* When, on the other hand, affective elements combine, *new simple feelings* arise, which unite with those originally present to make *intensive* affective units of composite character.

lassification

3. The classification of psychical compounds is naturally based upon the character of the elements that enter into them. Those composed entirely or chiefly of sensations are called *ideas*, those consisting mainly of affective elements, *affective processes*. The same limitations hold here as in the case of the corresponding elements. Although compounds are more the products of immediate discrimination among actual psychical processes than are the elements, still, there is in all exactness no pure ideational process and no pure affective process, but in both cases we can only abstract to a certain extent from one or the other component. As in the case of the two kinds of elements, so here, we can neglect the accompanying subjective states when dealing with ideas, but we must always presuppose some idea when giving an account of the affective processes.

We distinguish, accordingly, three chief forms of *ideas*: 1) intensive ideas, 2) spacial ideas, 3) temporal ideas; and three forms of *affective processes:* 1) intensive affective combinations, 2) emotions, 3) volitions. Temporal ideas constitute a sort of link between the two kinds of compounds, for certain feelings play an important part in their formation.

§ 9. INTENSIVE IDEAS.

General attributes intensive ideas

1. A combination of sensations in which every element is connected with every other element in exactly the same way is called an *intensive idea*. Thus, for example, a compound clang made up of the tones *d*, *f* and *a* is such an intensive idea. For the immediate perception each of the partial combinations into which this compound clang can be resolved, as *df*, *da*, *fd*, *fa*, *ad*, *af*, are all quite equivalent, in whatever order they are thought of. We may, accordingly, define intensive ideas, as *combinations of sensational elements, in which the order of the elements may be indefinitely varied.*

It follows from their nature, that intensive ideas do not have, arising from the way in which their elements are united, any characteristics by means of which they can be resolved into separate parts. Such a resolution is possible only through differences in the constituent elements themselves. Thus, we discriminate the elements of the compound clang *d f a*, only because we hear in it the qualitatively different tones *d*, *f* and *a*. Still, the separate components in such a unitary idea are less clearly distinguishable than in their isolated state. This relative suppression of the elements which is of great importance in all processes of perception, we call in general the *fusion of sensations*, and in particular, for intensive ideas, *intensive fusion*. If the connection of one element with others is so close that the single element can be perceived as a part of the whole only through unusual concentration of the attention aided by experimental variation of the conditions, we call the fusion

tensive fusion = relative suppression of elements
connection of elements [illegible]
mplete
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complete. If, on the other hand, the elements are immediately recognized in their proper qualities, and merely recede somewhat into the background in comparison with the impression of the whole, we call the fusion *incomplete.* If certain particular elements are more prominent in their characteristic qualities than others, we call them the *predominating elements.* The concept of fusion as here defined is a purely *psychological* concept which must be assigned to its appropriate place among the processes of association to be discussed later (§ 16, 4).

In reality, every intensive idea always enters into certain spacial and temporal combinations. Thus, for example, a compound clang is always a process having a certain duration, and is at the same time localized by us in some direction or other, though often only very indefinitely. But since these temporal and spacial attributes can be indefinitely varied, while the intensive character of the idea remains the same, we may abstract from space and time in investigating the intensive attributes.

[illegible] of the [illegible] [illegible] [illegible] [illegible] [illegible]

2. Among *ideas of the general sense* we have intensive fusions in the form of combinations of sensations of pressure with those of heat or cold, or in combinations of pain sensations with those of temperature or pressure. All these fusions are incomplete, and very often there is no decidedly predominating element. The combinations of certain sensations of *smell* and *taste* are more intimate. This is obviously favored on the physiological side by the proximity of the sense-organs, and on the physical side by the uniform connection between certain stimulations of the two senses. In such cases, the more intense sensations, are, generally, the predominating elements, and when these are the sensations of taste, the composite impression is usually regarded as a taste quality only. Thus, most of the impressions known in

ordinary life as "tastes", are in reality combinations of tastes and smells.

The greatest variety of intensive ideas, in all possible gradations of complexity, is presented by the *sense of hearing.* The relatively most simple of these ideas and those which are most closely related to simple tones, are the *single clangs.* As more complex forms, we have *compound clangs. Complex noises* may arise from compound clangs when these are united with sensations of simple noises, and also under certain other circumstances.

Intensive auditory Idea

Single Clan

3. A *single clang* is an intensive idea which is made up of a series of tonal sensations regularly graded in quality. These elements, the *partial tones* of the clang, form a complete fusion, in which the sensation of the lowest partial tone becomes the predominating element. The pitch of the clang is determined by this *principal* tone. The other elements are higher and are, accordingly, called *overtones.* The overtones are all grouped together under the name clang-color which is thus recognized as a second determinant of the clang, added to the predominating tone. All the partial tones that go to determine the clang-color are placed along the tonal line at certain regular intervals from the principal tone. The complete series of possible overtones in a clang consists of the first octave of the principal tone, the fifth of this octave, the second octave of the principal tone and the major third and the fifth of this second octave, etc. This series corresponds to the following proportions between the number of objective tonal waves:

1 (principal tone), 2, 3, 4, 5, 6, 7, 8, ... (overtones).

When the pitch of the principal tone remains constant, only the second determinant of the tonal quality, the *clang-color*, can vary according to the number, position, and relative intensity of the overtones. In this way we can explain the great variety of clang-colors in musical instruments, as well as the fact that for every instrument the clang-color changes somewhat with the pitch; for in the case of low tones the overtones are generally relatively strong, in the case of high tones relatively weak, while they disappear entirely when they are too high to be audible.

From a psychological point of view the chief condition for the rise of a single clang, is the complete, or approximately complete, fusion of several tonal sensations with only *one* predominating element. As a rule, it is impossible to distinguish with the unaided ear the overtones in a clang. They can be made perceptible by the use of resonators which are tuned to the overtones sought, and are thus able to strengthen them through resonant reinforcement. After they have been isolated in this experimental way the stronger overtones can be successively heard in the clang if the attention is directed to them, even without the aid of the resonators.

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usion

4. There are three conditions which must be fulfilled if there is to be only *one* predominating element in a tonal fusion. First, one tone must be relatively more intense. Secondly, in its qualitative relations to the other partial tones, the principal tone must be the *fundamental* of a series whose members are all harmonious. Thirdly, all the partial tones must be sounded at exactly the same time. This coincidence in time is objectively guaranteed by deriving the clang from a unitary source, (that is, producing the clang through the vibrations of one string, one reed-pipe, etc.). A failure to comply with the first condition does not destroy the idea of a single clang. If, on the other hand, the second condition is not fulfilled the combination becomes a *compound clang* when the predominating fundamental is wanting, or it becomes a *noise* when the series of tones is not harmonious, or finally, it becomes a mixed form, between a clang and a

noise, when both parts of the condition are unfulfilled. If the third condition is not met the single clang may again pass into a compound clang. A series of simple clangs from a number of tuning-forks which should unite to form a single clang so far as intensity and quality are concerned, always produces in reality the idea of a compound clang. Compd. Clan

5. A *compound clang* is an intensive combination of single clangs. It is in general an incomplete fusion with several predominating elements. There are, as a rule, all possible grades of fusion in a compound clang, especially when it is made up of single clangs of composite quality. In such a case, not only does every single clang form a complete fusion in itself, but these single clangs fuse the more completely with one another the more their fundamentals approach the relation of elements of a single clang. So it comes that in a compound clang made up of single clangs rich in overtones, those components whose fundamentals correspond to the overtones of some other single clang in the compound, fuse more completely with the related clang than with others. The other clangs, in turn, fuse the more completely the more their relation approaches that of the first members of a series of overtones. Thus, in the compound clang *c e g c′* the clangs *c* and *c′* form a nearly complete fusion, while the fusions of the clangs *c* and *g*, *c* and *e*, are incomplete. Still less complete is the fusion between *c* and $e^{\flat}$. A determination of the degree of fusion may be obtained in all these cases by allowing an observer to hear the compound clang for a very brief interval, after which he is to decide whether he perceived only *one* clang or several. This experiment is repeated many times, and the relative number of judgments in favor of the unity of the clang is a measure for the degree of fusion. Differen

6. Besides the elements contained in the single clangs of a compound, there always arise from the combination of tones

vibrations in the auditory organ, additional elements which cause new tonal sensations, characteristic of the different kinds of compound clangs. These may also fuse more or less completely with the original clang. They are sensations of *difference-tones;* they correspond, as their name indicates, to the difference between the number of vibrations in two primary tones. Some of these tones are due to the interference of sound waves in the outer air, outside of the ear (objective difference-tones). Such tones can be reinforced by properly tuned resonators inserted in the ear. Other difference-tones arise within the ear itself, either through the interference of the sound waves in the organs of the outer ear, especially in the tympanic membrane and in the chain of ossicles, or else through interferences in the inner ear. This second class of difference-tones (subjective difference-tones) can not be reinforced by using resonators. Through the presence of these difference-tones compound clangs become very complex psychical compounds, for such difference-tones may result not merely from the interference of the primary tones of the complex clang, but also from the interference of overtones. It is even possible for the difference-tones to interfere with each other, or with the primary tones. To distinguish these various classes of difference-tones they are designated as difference-tones of the first order, second order, third order, etc. The strongest of these difference-tones are those which result from the interference of the primary tones and then follow in general those which are *lower* in pitch than the primaries[1]. The fusion of the difference-tones with the primary tones of the compound clang is the more complete the weaker the difference-tones, and the more nearly they correspond to tones which are harmonious with the original elements of the clang. The difference tones are, accordingly, as a result of these characteristics, to be compared in respect to their importance for the compound clang as a whole, with overtones in their relation to simple clangs. Noise

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[1] In addition to difference-tones there may arise also, as HELMHOLTZ has shown, under similar conditions of interference *summation-tones*, the number of vibrations in which corresponds to the sum of the number of vibrations in the two primaries. The general term *combination-tones* is used to cover both the difference-tones and the

7. A compound clang may pass through all possible intermediate stages into a third form of intensive auditory ideas, namely, ideas of *noise*. When two tones are no longer included within a series of harmonious tones and when at the same time the difference between the number of their vibrations does not exceed certain limits (for higher tones about sixty vibrations and for lower thirty or even fewer) there arise interruptions in the compound clang, which correspond in number to the difference between the number of vibrations in the primary tones. These interruptions are due to the alternating coincidence of like and opposite phases of vibration. They are called *beats* when they consist merely in successive weakenings and reinforcements of the clang. When, on the other hand, full breaks appear in the clang, a result which appears most frequently in the case of low tones, we speak of *tonal beats*. If the differences in the number of vibrations exceed the numbers mentioned, the tones are at first heard as continuous, for the interruptions disappear, but they are harsh. Later the harshness disappears and we have *pure dissonance*. As a rule beats resulting from the interference of difference-tones are perceived as combined with this impression of roughness and pure dissonance. Ordinary dissonance is, accordingly, made up

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summation-tones. The summation-tones are in general very weak and coincide, for the most part, with the overtones. They have therefore no significance in the perception of clangs.

in a very complex manner, of beats, of roughness from the combined tones, and of pure dissonance. In this complex of tones each of the elements, namely, primary tones, over-tones, and difference-tones of various orders, has its place. If the elements of dissonance, that is, if beats, tonal beats, and roughness, are combined in sufficiently great numbers through the simultaneous sounding of a great number of tones, the whole complex becomes ultimately a *noise*. On the psychological side this means that the predominating tonal elements disappear entirely or become mere modifying elements in the total idea. In the case of noises which last for a short interval only, the general pitch of the most intensive elements is determinative for our perception. In the case of noises which last longer, the form of the disturbance resulting from the rapidity of the beats, from the accompanying tonal beats, etc., also has an influence.

Human articulations are characteristic examples of different forms of noise. The vowels are intermediate between clangs and noises with predominantly clang character; the resonants are noises of long duration, and the proper consonants, noises of short duration. In whispers the vowels become simply noises. The fact that the differences in vowels are perfectly distinct in whispers, goes to prove that the character of vowels depends essentially on their noise elements. It is probable that simple sensations of noise (p. 55) enter, together with the numerous tonal elements into all experienced noises. The irregular air-vibrations arising from the disturbances in the tonal waves, excite both the nervous elements in the vestibule of the labyrinth, and also the auditory nerve-fibres themselves.

Theories / Clang analysis & Tonal Fusion.

7 a. The process of "fusion" occurs here, in the case of intensive tonal fusion, under the simplest possible conditions.

We shall come upon fusions of a somewhat different form when we take up spacial and temporal ideas. In the case of tonal fusions the compound resulting from the fusion process differs relatively less from a simple addition of its elements, than do the extensive fusions. The general characteristics which distinguish an intensive tonal fusion from a mere sum of the single tones which enter into the fusion, are *three* in number. First, many or all (as for example in many noises) of the elements sink into insignificance as compared with the total impression of the whole compound. Secondly, there is a union of all the elements into a single unitary idea with a unitary affective value, as may be seen with especial clearness in harmonious chords. Thirdly, and finally, certain dominating elements stand out above the others, as for example, the fundamental tone in a single clang. The first and second characteristics are constant, the third is variable. In the case of complex clangs the third characteristic is less noticeable than in the case of single clangs, and in the case of noises it is entirely absent. Furthermore, it will be noted that all of these characteristics are *psychological*, so that the concept fusion is also a purely psychological concept. And since like, or analogous, phenomena appear whenever we find psychological elements combining with each other, there is no reason for seeking to find in these characteristics anything except an expression of a certain regular form of psychological action. Some investigators have strayed from the simple empirical facts in their use of the concept "tonal fusion", and have regarded the synthesis of the elements into a fusion-product as a *logical* act added to the sum of the sensory elements — as a kind of judgment of unity (STUMPF). In opposition to this view it is to be recognized most clearly that tonal fusions present themselves as pure examples of elementary psychical processes of fusion. The incorrect logical theory obviously arises from the confusion of logical reflections about psychical experiences with the experiences themselves — a form of confusion which is so frequently, even today, carried over from popular psychology into scientific psychology (p. 14).

The resonance hypothesis formulated by HELMHOLTZ (see p. 44 and 57) was the first which attempted to give any account of one of the most important of the phenomena which appear in tonal fusions, namely, of the synthesis into a single clang idea of all the elementary tonal sensations into which a clang may be separated even in its objective nature. It is assumed that certain parts of the auditory organ are so tuned that tonal waves of a given rate always set in sympathetic vibration only the part correspondingly tuned. This explains in a general way the analyzing ability of the auditory sense. But it is not to be overlooked that the resonance hypothesis succeeds in giving a physiological explanation of only one side of the process of tonal fusion, namely, the persistence of single sensations in the total intensive idea. It does not explain the other side of the process, that is, the more or less complete union of the elements. Since the tonal elements which produce a given intensive clang idea both continue as real sensations in this idea, and at the same time give up more or less completely their independent existence in the idea as a whole, it is possible that tonal fusion is a psychical process and requires as a psychical process, no special physiological explanation. But since this fusion is very different under different *objective* conditions, as, for example, when the impressions are due to the combined vibrations from a single source or to vibrations from several distinct sources; these differences must have some physiological and physical grounds for their explanation. The most natural way to attempt such an explanation is properly to supplement the resonance hypothesis. If we assume that besides the analyzing parts of the auditory organ, that is, the resonant membrane, still others exist which are affected by the total, unresolved clang, we have a sufficient physiological substratum for the different effects of the various conditions. We are thus supplied with two forms of stimulation, one *diffuse* and the other *selective*. Through the combined effects of the two it is possible to explain the fact that difference-tones of low pitch sometimes exceed in intensity the primary tones (HERMANN), and that the interruptions of a single tone through beats of proper rapidity may unite to form a second tone sensation (R. KÖNIG). These latter facts, as well as the earlier ones described, could not be explained by the resonance hypothesis alone. Where the seat of the diffuse tone stimulation is situated, whether, for example, it is in the sensory area in the vestibulum, or in the sensory fibres of the resonating membrane itself, it is impossible to say with any definiteness. It has never been possible to explain the phenomena of clang analysis with the same degree of completeness by means of any of the theories of hearing which have not accepted the resonance hypothesis. There is nothing, however, in the fact that the resonance hypothesis has proved itself up to this time indispensable, which could stand in the way of an effort to supplement the hypothesis in the manner described. For a treatment of the attributes of the complex feelings which arise with complex clangs (feelings of harmony and discord) see § 12, 9.

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General Concept of Extensive Ideas.

§ 10. SPACIAL IDEAS.

1. Spacial and temporal ideas are fully distinguished from intensive ideas by the fact that the parts of spacial and temporal ideas are united, not in an arbitrarily variable order, but in a definitely fixed order, so that when the order is thought of as changed the idea itself changes. Ideas with such a fixed arrangement are called in general *extensive* ideas (p. 102).

Special charact. of Spacial Ideas.

Of the possible forms of extensive ideas, *spacial* ideas are distinguished by the fact that in them it is only in *respect to the relation of the parts to one another*, that there is a *fixed arrangement.* With respect to the relation of the parts to the ideating subject there is no such fixed arrangement. This relation of the parts to the subject may be thought of as varied indefinitely. The objective independence of spacial compounds from the ideating subject is expressed by saying that *spacial compounds are capable of movements backwards and forwards and of rotation around any axis.* The number of directions in which movement and rotation may take place, is limited. They may all be reduced to *three* dimensions, in each of which it is possible to advance in two opposite directions. The number of directions in which the parts of a single compound may be arranged as well as the number in which various compounds may be arranged with reference to one another, is the same as the maximal number of directions in which movement and rotation are possible. This is what we call the *three-dimensional* character of space. A single spacial idea may, accordingly, be defined as a *three-dimensional compound whose parts are fixed in their location with reference to one another, but capable of indefinite variation in their location with reference to the ideating subject.* This definition neglects, of course, the frequent changes which occur in reality in the arrangement of the parts of spacial compounds. When these changes take place, they are to be regarded as transitions from one idea to another. This three-dimensional arrangement of spacial ideas must of necessity include one-dimensional and two-dimensional arrangements as special cases. In such cases, however, the wanting dimensions must always be added in thought as soon as the relation of the idea to the ideating subject is taken into account. [illegible]

yol. per[illegible]
[illegible])
[illegible] idea

2. This relation to the ideating subject, which is really present in all spacial ideas, renders it from the first psychologically impossible that the arrangement of the elements in

such an idea should be an original attribute of the elements themselves, in any such way as intensity or quality of sensations are original attributes of these elements. It is obvious, rather, that this arrangement results from the bringing together of these elements, and arises from some new psychical conditions which depend upon this coexistence. If this is not admitted, it becomes necessary not only to attribute a spacial quality to every single sensation, but also to postulate for every sensation, however limited, a simultaneous idea of the whole of three-dimensional space in its location with regard to the ideating subject. This would lead to the acceptance of an *a priori* space-perception, prior to all concrete sensations, which is not only contradictory to all our experiences as to the conditions of the rise of psychical compounds in general, but also contradictory to our knowledge of all the influences that underlie spacial ideas.

Kinds of
Spacial
Idea

3. All spacial ideas are arrangements either of *tactual* or of *visual sensations*. Indirectly, through the connection of other sensations with either tactual or visual ideas, the spacial relation may be carried over to other sensations. In the cases of touch and sight, it is obvious that the extended surface of the peripheral sense-organs, and their equipment with organs of movement, which render possible a varying location of the impressions in regard to the ideating subject, are both favorable conditions for an extensive, spacial arrangement of the sensations. The *tactual* sense is the earlier of the two here in question, for it appears earlier in the development of organisms and shows the structural relations in much coarser, but for that reason in many respects much plainer, form than does the more delicately organized visual organ. Still, it is to be noted that where vision is present, the spacial ideas from touch are greatly influenced by the ideas from sight, because of the higher development of vision.

calization of touch Stimuli

A. SPACIAL TOUCH IDEAS.

4. The *simplest* possible touch idea is that of a *single impression from a point on the skin.* If such an impression is presented even when the eyes are turned away, there arises a definite idea of the *place touched.* Introspection shows that this idea, which is called the *localization of the stimulus*, is not, under the usual condition where vision is present, immediate, as we should expect it to be if the spacial quality were an original attribute of sensations, but it depends upon a secondary, generally very obscure, *visual idea* of the region touched. Localization is, therefore, more exact near bounding lines of the touch-organs than on the uniform intervening surfaces, since these bounding lines are more prominent in the visual images. The rise of a visual idea from the tactual impression, even when the eyes are turned away, is possible because every point of the organ of touch gives to the touch sensation a peculiar qualitative coloring, which is independent of the quality of the external impression, and is probably due to the character of the structure of the skin. This qualitative coloring varies from point to point and is never exactly the same in two separate regions.

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This local coloring is called the *local sign* of the sensations. It varies from point to point in different regions of the skin at very different rates: rapidly on the tip of the tongue, on the ends of the fingers, and on the lips; slowly on the broader surfaces of the limbs and trunk. A measure of this variation may be obtained by applying *two* impressions near each other to any region of the skin. So long as the distance of the impressions is less than that of distinguishable local signs, the two impressions are perceived as a single one, but so soon as they pass this limit they are perceived as spacially separate. The smallest, just noticeable distance between two impressions is called the *space threshold for touch*. It varies from one or two millimetres (tips of tongue and fingers) to sixty-eight millimetres (back, upper arm, and leg). On the pressure-spots (p. 52), when the stimuli are favorably applied, still shorter distances can be perceived. Then, too, the threshold is dependent on the condition of the tactual organ and on practice. As a result of the first, for example, the threshold is smaller for children than for adults, since the differences in structure that condition the local signs, are obviously more crowded together. As a result of practice, the threshold is smaller in the case of the blind than it is in the case of those who have vision. This is especially true of the ends of the fingers which are most used for touching.

Rise of Spacial Touch Ideas in normal cases with

5. The influence of visual ideas of the regions touched, as just described, teaches that the localization of tactual impressions and the spacial arrangement of a number of such impressions is not due to an original spacial quality of cutaneous points or to any primary space-forming function of the tactual organ. On the contrary, it presupposes spacial ideas of sight. These can be made use of, to be sure, only because the various parts of the tactual organ have certain qualitative attributes, local signs, which arouse the visual image of the part touched. But there is no reason for attributing an immediate spacial relation to the local signs themselves; it is obviously enough that they act as qualitative signals to arouse the appropriate visual images. This connection with vision depends upon the frequent union of the two. The keenness of localization will, therefore, be aided by all the influences that increase either the clearness of the visual images or the qualitative differences in local signs.

We may describe the formation of spacial ideas in this case as the arrangement of tactual impressions in visual images already present. The whole process is a consequence of the constant connection of these visual images with the qualitative local signs of the tactual impression. The union of the local signs and the visual images of the corresponding region may, then, be regarded as an *incomplete, but very constant, fusion*. The fusion is incomplete because both visual image and tactual impression retain their independent character; but it is so constant that, when the state of the tactual organ remains the same, the fusion seems to be invariable. This last fact explains the relative certainty of localization. The predominating elements of this fusion are the tactual sensations. For many persons the visual images are pushed so far into the background that they can not be perceived with any certainty, even when examined with the greatest attention. The perception of space, in such cases, is perhaps an immediate function of tactual and motor sensations, as for the blind (v. inf. 6). As a rule, however, more careful observation shows that it is possible to recognize the position and distance of the impressions only by attempting to make more distinct the indefinite visual image of the region touched. Tactual Sense of the Blind

6. The conditions that hold when vision is present, are essentially different from those found in cases of *blindness*, especially blindness which is congenital, or acquired early in life. Persons who become blind later retain for a long time memory images of familiar visual objects, so that the spacial ideas of touch always remain, to some extent, products of a fusion between tactual sensations and visual images. But these visual images can not be continually renewed, so that the persons in question make large use of movements. The tactual sensations that arise from the joints and muscles when the hand passes from one tactual impression to another (p. 52), serve as a measure for the movement executed and,

at the same time, as a measure for the distance between the two impressions. These sensations of movement, which in acquired blindness are additions to the gradually fading visual images and in part substitutes for them, are, in congenital blindness, the only means present from the first for the formation of an idea of the relative position and distance of the single impressions. We observe in congenital blindness continual movements of the touch-organs, especially the fingers, over the object. Added to these movements are a more concentrated attention to tactual sensations and a greater practice in their discrimination. Still, the low grade of development of touch, as compared with sight, always shows itself in the fact that the perception by the blind of continuous lines and surfaces is much less perfect than the perception of points arranged in various ways. The necessity of making a *blind-alphabet* of arbitrary figures formed by various combinations of raised points, is a proof of this. Thus, for example, in the ordinary alphabet (BRAILLE's) one point represents A, two points in a horizontal line B, two points in a vertical line C, etc. With six points at most all the letters can be formed, but the points must be far enough apart to be perceived as separate with the end of the index finger. The way in which this alphabet is read shows clearly how the space ideas of the blind have developed. As a rule the index fingers of both hands are used in blind reading. The right finger precedes and apprehends a group of points simultaneously (synthetic touch), the left finger follows somewhat more slowly and apprehends the single points successively (analytic touch). Both the synthetic and analytic impressions are united and referred to the same object. This method of procedure shows clearly that the spacial discrimination of tactual impressions is no more immediately given in this case than in the case where vision was present, but that in the case of the blind the movements by means of which the finger that is used for analytic touch passes from point to point, play the same part as did the accompanying visual ideas in the normal cases with vision.

An idea of the extent and direction of these movements can arise only under the condition that every movement is accompanied by an inner tactual sensation (p. 52, 6). The assumption that these inner tactual sensations are immediately connected with an idea of the space which is traversed in the movement, would be highly improbable, for it would not only presuppose the existence of a connate perception of surrounding space and of the position of the subject in respect to the same (p. 115), but it would also include another particular assumption. This is the assumption that inner and outer touch sensations, although they are otherwise alike in quality and physiological substrata, still differ in that inner sensations give, along with the sensation, an image of the position of the subject and of the spacial arrangement of the immediate environment. This would really necessitate a return to the Platonic doctrine of the memory of innate ideas, for the sensations arising from touch are here thought of as the mere external occasional causes for the revival of innate transcendental ideas of space.

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7. Apart from its psychological improbability, such an hypothesis as that just mentioned can not be reconciled with the influence exercised by practice on the discrimination of local signs and on the discrimination of differences in movements. There is, therefore, no way, except to attribute the rise of spacial ideas of the blind, as we did the spacial ideas of normal individuals (p. 117), to the *combinations of the sensations as presented in experience.* These combinations result from the fact that every pair of sensations, *a* and *b*, with their difference in local signs, always

have a corresponding inner touch sensation, α, accompanying the movement from one to the other, while two sensations, a and c, with a greater difference in local signs, have a more intense sensation of movement, γ. For the blind there is always such a regular combination of inner and outer touch sensations. It can not, therefore, be affirmed that either of these sensational systems, in itself, brings the idea of spacial arrangements; we can only say that this arrangement results regularly from the combination of the two. On this basis the spacial ideas of the blind, arising, as they do, from external impressions, may be defined as a product of the *fusion of external tactual sensations and their qualitatively graded local signs, with internal tactual sensations graded according to intensity.* The external sensations with their attributes as determined by the external stimulus, are the predominating elements in this fusion. They push the local signs with their qualitative peculiarities and the inner tactual sensations with their intensive attributes, so far into the background, that, like the overtones of a clang, all these secondary elements can be perceived only when the attention is especially concentrated upon them. Spacial ideas from touch are, accordingly due to a *complete* fusion (p. 103). Their characteristic peculiarity, in contrast with such fusions as intensive tonal fusions, is that the subordinate and supplementary elements are different in character, and are at the same time related to one another according to definite laws. They are different, for the local signs form a purely qualitative system, while the inner touch sensations which accompany the movements of the tactual organs, form a series of intensities. They are related, in that the motor energy used in passing through an interval between two points increases with the extent of the interval, so that, in proportion as the qualitative difference between the local signs increases, there must also be an increase in the intensity of the sensations which accompany the movement.

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8. The spacial arrangement of tactual impressions is thus the product of a *twofold fusion*. First, the subordinate elements fuse. That is, the various qualities of the local sign system, which is spread out in two dimensions, are related to one another according to the grades of intensity of the inner tactual sensations. Secondly, the tactual impressions as determined by the external stimuli, fuse with the product of the first union. Of course, the two processes do not take place successively, but in one and the same process, for the local signs and movements must both be aroused by the external stimuli. Still, the external sensations vary with the nature of the objective stimulus, while the local signs and internal tactual sensations are subjective elements, the mutual relations of which always remain the same even when the external impressions vary. This is the psychological condition for the *constancy of attributes* which we ascribe to space itself, in contrast with the great changeableness of the qualitative attributes of objects in space.

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9. After the spacial fusion of tactual sensations has once been effected, either one of the elements which took part in the fusion is able by itself, though perhaps in a limited degree, to bring about a localization of the sensations. In this way not only normal individuals with vision, but also the blind, even the congenitally blind, have an idea of the place touched, and can perceive as spacially separate two impressions that are far enough apart, even when the touch-organs remain perfectly quiet. Of course, the congenitally blind can have no visual image of the region touched, but they have instead of this an idea of a movement of the part touched and where several impressions are received, they have the idea of a movement from one to the other. The

same fusion takes place in ideas thus formed as takes place in the ordinary cases where movements are really present. The difference is that one factor, namely, the inner tactual sensation, is merely a memory image.

Ideas of one's own movements when vision is pres

10. In the same way, we have the converse process. The real contents of experience may be a sum of inner tactual sensations which arise from the movement of some part of the body, while no noticeable external tactual sensations whatever are given, and yet these internal sensations which accompany the movement may be the basis of a spacial idea. This is regularly the case when we have *pure ideas of our own movements.* If, for example, we shut our eyes and then raise an arm, we have at every moment an idea of the position of the arm. To be sure, external tactual sensations that arise from the torsion and folding of the skin, play some part here too, but they are unimportant in comparison with the internal sensations from the joints, tendons, and muscles.

It can easily be observed that where vision is present, this idea of position comes from an obscure visual image of the limb with its surroundings, which image is aroused even when the eyes are closed or turned away. This connection is so close that it may arise between the mere memory image of the inner tactual sensation and the corresponding visual idea, as is observed in the case of paralytics, where sometimes the mere will to execute a certain movement arouses the idea of a movement really executed. Evidently, the ideas of one's own movements depend, when vision is present, on incomplete fusions just as do the external spacial ideas of touch. The only difference is that here the internal sensations play the part which the outer sensations play in the former case. This leads to the assumption that the inner tactual sensations also have local signs, that is, the assumption that the sensations in the various joints, tendons, and muscles show certain series of local differences. Introspection seems to confirm this view. If we move alternately the knee-joint, hip-joint, and shoulder-joint, or even the corresponding joints on the right and left sides, the quality of the sensation varies a little each time, even if we neglect the fact that there is a visual image of the limb which can never be entirely suppressed.

Ideas of one's own movements in case of congenitally blind

11. From the relations that exist in the normal cases of persons who have vision, we can understand the way in which persons who are congenitally blind form ideas of their own movements. Here, instead of a fusion with a visual image, there must be a fusion of sensations of movement with the local signs. Outer tactual sensations also act as aids in this case. In fact, they are much more important here than when vision is present. The ideas of the blind as to their own movements are exceedingly uncertain so long as they are unaided by contact with external objects. When, however, they touch such objects, they have the advantage of greater practice with the external tactual sense and a keener attention to the same. The so-called "distance-sense of the blind" is a proof of this greater practice. It consists in the ability to perceive from some distance, without direct contact, a resisting object, as, for example, a neighboring wall. Now, it can be experimentally demonstrated that this distance-sense is made up of *two* factors: a very weak tactual stimulation of the forehead by the atmospheric resistance, and a change in the sound of the step. The latter acts as a signal to concentrate the attention so that the weak tactual stimulations can be perceived. The "distance-sense" disappears, accordingly, when the tactual stimulations are prevented by binding a cloth around the forehead or when the steps are rendered inaudible.

Ideas of posit of movement of whole body

12. Besides our ideas of the position and movements of the various parts of our body, we have also an idea of the *position and movement of our whole body*. The ideas of the position of parts of the body can never have anything but a relative significance; it is only when considered in connection with the idea of the body as a whole that they become absolute. The organ of orientation for this general idea is the *head*. We always form a definite idea of the position of the head; the other organs are localized, generally, indeed, very indefinitely, with reference to the head, each idea depending on the particular complexes of inner and outer tactual sensations presented in that case. The specific organ of orientation in the head is the system of semicircular canals, to which are added, as secondary aids, the inner and outer tactual sensations resulting from the action of the muscles of the head. The function of these canals as an organ of orientation can be most easily understood by assuming that inner tactual sensations with especially marked differences in local signs, arise in them through the influence of the changing pressure of the fluid medium which fills them. It is highly probable that *dizziness*, which comes from rapid rotation of the head, is due to the sensations caused by the violent movements of this fluid. This is in accord with the observations that partial derangements of the canals bring about constant illusions in localization, and complete derangement of the same is followed by an almost total suspension of the ability to localize.

Theories of the rise of Spacial Ideas found

12a. The antagonistic theories in regard to the psychical formation of spacial ideas, are generally called *nativism* and *empiricism*. The *nativistic* theory seeks to derive localization in space from connate properties of the sense-organs and sense-centres, while the *empiristic* theory seeks to derive it from the influence of experience. This discrimination does not give proper expression to the actual opposition that exists, for the assumption of connate spacial ideas may be attacked without affirming that these ideas arise through experience. This is the case when, as above, space perceptions are regarded as products of psychical fusions due both to the physiological properties of the organs of sense and organs of movement, and to the general laws governing the rise of psychical compounds. Such processes of fusion and the arrangements of sense impressions based upon them, are everywhere the conditions of our experience, but for this very reason it is inadmissible to call them "experience" itself. It is much more proper to point out the opposition which really exists as the opposition between *nativistic* and *genetic* theories. Genetic theories may then be subdivided into *empirical theories* and *theories of fusion.* In view of the fact that the associative processes in the fusion theories, are necessary even for the first formulation of experience, we may designate these theories as the *praeempirical* forms of genetic theory. It is to be noted that the widely accepted nativistic theories contain empirical elements, while, on the other hand, empirical theories contain nativistic elements, so that the difference is sometimes very small. Supporters of the nativistic view assume that the arrangement of impressions in space corresponds directly to the arrangement of sensitive points in the skin and retina. The special way in which the projection outward is effected especially in ideas of the distance and magnitude of objects and in the reference of a plurality of spacially separated impressions to a single object is accounted for as dependent upon "attention", "will", or even "experience". Supporters of the empirical theory, on the other hand, generally presuppose space as given in some way or other, and then interpret each single idea as a case of localization in this space, the particular localization being in each case due to some empirical motive. In the theory of spacial ideas from sight, tactual space is generally regarded as this originally given space; in the theory of tactual ideas, original spacial qualities have sometimes been attributed to inner tactual sensations. Thus, in the actual concrete theories empiricism and nativism are very ill-defined concepts. They agree in the use of the complex concepts of popular psychology, such as "attention", "will", and "experience", without any examination or analysis. In this respect they are different from the fusion theory, which seeks to discover, by means of a psychological analysis of the ideas, the elementary processes from which the ideas arise.

The special influence of the head on ideas of bodily position and movement shows itself in the phenomena of dizziness, and in the ideas which we form of movement through space when the body is carried along without effort on our own part. This special influence was originally attributed to certain parts of the brain, especially to the cerebellum. And it is not unlikely that the cerebellum participates in a measure directly, and in a measure indirectly as the centre for the peripheral organ of orientation, in the processes of orientation and in the disturbances of orientation. As to the peripheral organs of orientation the partial and total exterpations which have been performed on the semicircular canals, especially on the canals of birds, make it evident that the most important of these peripheral organs of orientation are the semicircular canals. In addition, however, it must not be overlooked that external touch sensations and visual perceptions are of supplementary importance, especially in that they make possible a gradual correction of the disturbances of orientation which arise when the semicircular canals are disabled. Further confirmation of a striking type is found for the belief that the canals are of the first importance in the observation that deaf mutes very frequently suffer from disturbances in orientation. Such disturbances probably appear in every case in which the pathological conditions which, as is usual in such deafness, appear early and attack the labyrinth, have also attacked the canals.

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Ex. Characters
Visual
Ideas

B. SPACIAL SIGHT IDEAS.

13. The general properties of the touch sense are repeated in the visual sense, but in a more highly organized form. Corresponding to the sensory surface of the outer skin, we have here the retina with its rods and cones arranged in rows and forming an extraordinarily fine mosaic of sensitive points. Corresponding to the movements of the tactual organs, we have the movements of both eyes in fixating objects and following their bounding lines. But there is this difference, while tactual impressions are perceived only through immediate contact with the objects, the refractive media in front of the retina throw upon the visual surface inverted reduced images. These images allow space for a large number of simultaneous impressions, and the ability of light to traverse space makes it possible for both neighboring and distant objects to yield impressions. Vision thus becomes a *distance sense* in a much higher degree than hearing.

Ex. Factors
such
Ideas

14. With regard to its spacial attributes, every visual idea may be resolved into *two* factors: 1) the location of the single elements in relation to one another, and 2) their location in relation to the ideating subject. Even the idea of one single point of light, contains both these factors, for we must represent a point in some spacial environment, and also in some direction and at some distance from ourselves. These factors can be separated only through deliberate abstraction, never in reality, for the relation of any point in space to its environment regularly determines its relation to the ideating

subject. As a result of this dependence, the analysis of visual ideas may better start with the location of the elements in relation to one another, and then take up later the location of the compound in relation to the subject.

a. *The Location of the Elements of a Visual Idea in Relation to One Another.*

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15. In the perception of the reciprocal relations between elements of a visual idea, the characteristics of space perception through the tactual sense are all repeated, only in a much more highly organized form, and with a few modifications which are important in determining the special character of visual ideas. Thus, in vision as in touch, we immediately connect with the simplest possible impression of a point the idea of its *place* in space; that is, we give it a certain definite position in relation to the parts of space about it. This localization is not effected, however, as in touch, by the direct reference of the impression to the corresponding point of the sense-organ itself; we project it rather into a *field of vision*, which lies at some distance outside of the ideating subject. Here too we have a measure, as in the case of touch, of the accuracy of localization, in the distance at which two points can be just distinguished as spacially different. The distance is not given in this case as a directly measurable linear extension on the sensory surface itself, but as the shortest perceptible interval between two points in the field of vision. The field of vision may be at any distance whatever, so that it is best to use as a measure for the fineness of localization, not a linear extension, but an *angle*, the angle formed by the intersection of the lines passing from the points in the field of vision, through the optical centre of the eye, to the corresponding retinal

points. This *angle of vision* remains constant so long as the size of the retinal image is unchanged, while the distance between the points in the field of vision increases in proportion to their distance from the subject. If an equivalent linear distance is sought in place of the angle of vision, it can be found in the diameter of the retinal image. This may be calculated directly from the angle and the distance of the retina from the optical centre of the eye.

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16. The measurements of the *keenness of visual localization* made according to this principle show that there is a great difference in different parts of the field of vision, corresponding to the differences found for different regions of the tactual organs (p. 117). Still, the distances that measure the smallest perceptible visual intervals are all very much smaller than in the case of touch. Then too, while there are many regions of finer discrimination scattered over the tactual organ, there is only *one* region of finest discrimination in the field of vision. This is the middle of the field of vision which corresponds to the centre of the retina. From this region towards the periphery the fineness of localization diminishes very rapidly. The whole field of vision, or the whole retinal surface, is, accordingly, analogous to a single tactual region, as, for example, that of the index finger, except that the visual region much surpasses the tactual in fineness of localization, especially at the centre, where two impressions at a distance corresponding to 60″—90″ in the angle of vision, are just distinguishable; at two degrees and a half from the centre toward the periphery, the smallest perceptible extension is 3′ 30″; and at eight degrees toward the periphery it increases to 1°.

Object of
indirect
vision

In normal vision we turn the eye towards objects of which we wish to gain more accurate spacial ideas, in such a way that these objects occupy the middle of the field of vision, their images falling, as a result, on the centre of the retina. We speak of such objects as seen *directly*, of all others, which lie in the eccentric parts of the field of vision, as seen *indirectly*. The centre of the region of direct vision is called the *point of regard*, or the *fixation-point*. The line that unites the centre of the retina with the centre of the field of vision is known as the *line of regard*.

If we compute the distance on the retina that corresponds to the smallest angle of vision at which two points in the centre of the field of vision may be perceived as separate, we shall find it to be .004 to .006 mm. This distance is about equal to the diameter of a retinal cone, and since the centre of the retina has only cones and these are so close together that they are in direct contact, it may be concluded with probability that two impressions must fall upon at least two different retinal elements if they are to be perceived as separate in space. This view is supported by the fact that in the peripheral regions of the retina the rods and cones, which are the two forms of elements sensitive to light, are really separated by greater intervals. It may, then, be assumed that the *keenness of vision* is directly dependent on the proximity of the retinal elements to one another, for two impressions can be distinguished as spacially different only when they act upon different elements.

Effects of metamorphosia.

16a. Because of this relation between the keenness of vision and the arrangement of retinal elements, it has often been concluded that every retinal element has from the first the property of localizing any stimulus that acts upon it, in that position in space which corresponds to its own projection in the field of vision. In this way the attempt has been made to explain the fact that the visual sense represents its objects in an external field of vision at some distance from the subject, as a connate energy of the retinal elements or of their central connections in the visual centre in the brain. There are certain pathological disturbances of vision that seem at first sight to confirm this assumption. When some region of the retina is pushed out of place as a result of inflammation underneath, certain distortions in the images, the so-called *metamorphopsia*, arise. The extent and direction of these distortions can be fully explained when it is assumed that the displaced retinal elements continue to localize their impressions as they did when in their normal positions. But it is obvious that these distortions of the images, when they appear, as they do in most cases, as continually changing phenomena, during the gradual formation and disappearance of the excretion, furnish us with no more evidence of a connate energy of localization in the retina, than does the readily observed fact that distorted images of objects are seen when one looks through prismatic glasses. Furthermore, if a stationary condition is gradually reached, the metamorphopsia disappear, and that, too, not only in cases where it may be assumed that the retinal elements return to their original position, but even in those cases where such a return is entirely improbable on account of the extent of the affection. In cases like the latter, the development of a new connection between the single retinal elements and their corresponding points in the field of vision, must be assumed 1). This conclusion is supported by observations made with normal eyes on the gradual adaptation to such distorted images as are produced by external optical appliances. If a pair of prismatic glasses be worn before the eyes, marked and disturbing distortions of the images are the regular results. The straight bounding lines appear bent and the forms of the objects are thus distorted. These disturbances gradually disappear entirely if the glasses are worn some time.

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1) A process analogous to this elimination of the metamorphopsia is sometimes observed in *binocular* vision when the disturbances arising from *squinting* are gradually overcome. When the squinting begins, the two lines of regard no longer meet in the field of vision, so that double images of objects arise. These may gradually disappear, however, if the condition of the eyes remains perfectly stationary; a new set of relations is developed for the retinal elements of the squinting eye.

When the glasses are removed, the distortions may appear in the opposite direction.

Ocular Movements

17. Besides the retinal sensations there are other psychical elements that always take part in the spacial arrangement of light impressions. The physiological properties of the eye point *a priori* to the sensations that accompany *ocular movements*, as such elements. These movements obviously play the same part in the estimation of distances in the field of vision as do the tactual movements in the estimation of tactual impressions. By means of a most admirably arranged system of six muscles, the eye can be turned in all directions about its centre of rotation, which is fixed in its relation to the head. It is thus well suited to following continuously the bounding lines of objects or to passing each time in the shortest line from a given fixation-point to another. Movements in the direction which corresponds to the position of the objects most frequently and closely observed, namely, movements downward and inward are favored above the others by the arrangement of the muscles. Furthermore, the movements of the two eyes are so adapted to one another through the synergy of their innervation, that normally the two lines of regard are always turned upon the same fixation-point. In this way a cooperation of the two eyes is made possible which not only permits a more perfect perception of the position of objects in relation to one another, ~~but also~~ furnishes the most essential means for the determination of the spacial relations of objects to the subject (24 seq.).

Relation of ocular movements to feeling

18. The phenomena of vision teach that the idea of the *relative distance* of two points from each other is dependent on the motor energy employed in passing through this distance, just as the discrimination of two distinct points in the

field of vision depends on the arrangement of the retinal elements. The motor energy becomes a component of the idea through its connection with a sensation of tension which can be perceived, especially in extensive movements and by comparing ocular movements in various directions. Thus, for example, an upward movement of the eyes is clearly accompanied by more intense sensations than an equal downward movement; and the same is true of outward movements of the eye as compared with inward movements.

The influence of these inner tactual sensations is most apparent in the fact that the disturbances in localization which arise from partial paralysis of single ocular muscles correspond exactly to the changes in the amount of energy required to move the eye. The general principle of such disorders is that the distance between two points seems greater when these points lie in the direction of the more difficult movement. The more difficult movement has a correspondingly more intense sensation of tension which intense sensation under normal conditions accompanies a more extensive movement. As a result, the distance passed through appears greater. Furthermore, the same illusion may appear for distances that lie in the direction of difficult movement, but have not been actually passed through, for the standard acquired during movement determines the motor impulse in the eye even when it is not moved.

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movement

19. Similar variations can be demonstrated for the normal eye. Although the ocular muscles are so arranged that their movements in various directions require about the same amount of exertion, still, there is not exact equality in this respect. The reasons for the existing differences are connected with the adaptation of the eye to its functions. The neighboring objects of our immediate environment, on which the lines of regard must be converged, are the ones at which

we most often look. For this reason, the muscles of the eye have so adapted themselves that the movements for the convergence of the lines of regard are the easiest, particularly those directed downwards as compared with other possible movements of convergence. This facilitation of convergent movements is brought about by the special mode of placing the muscles which move the eye upward and downward. These muscles, the superior rectus and the inferior rectus, do not lie exactly in the vertical median plane of the eye, from which position they would give the eye a simple upward and downward vertical movement; they lie rather at such an angle to this median plane that their contraction results in an inward, as well as an upward and downward movement. Furthermore, each of these recti muscles is supplemented by an oblique muscle, the superior rectus by the inferior oblique, and the inferior rectus by the superior oblique. These oblique muscles aid in producing upward and downward movements and at the same time counterbalance the rotation movements produced in the eyes by the asymmetrical placing of the recti muscles. As a result of the greater complexity of muscular activity in upward and downward directions, the exertion required to run over lines in these directions is greater than the exertion required for horizontal lines, where only the internal and external recti act. Furthermore, the relative ease of downward movements of convergence as contrasted with upward movements shows itself partly in the differences in intensity of sensations accompanying the downward movements, as already remarked, and partly in the fact that downward convergence is involuntarily too great and upward convergence too small.

There are certain *constant optical illusions depending on the position of a given object in the field of vision*, which correspond to these differences in the motor mechanism.

They are of two kinds: illusions of *direction*, and those of *length*.

Both eyes are subject to an illusion as to the *direction of vertical lines in the field of vision*. Such a line whose upper end is inclined 1°—3° outward, appears vertical, and one really vertical, seems inclined inward. Since the illusion is in opposite directions for the two eyes, it disappears in binocular vision. It can obviously be explained by the fact just noted, that the downward movements of the eyes are connected with an involuntary increase in convergence, and the upward movements with a decrease in convergence. This deflection of the movement from the vertical is not noticed in itself, it is referred to the object as a deflection in the opposite direction.

An equally regular *illusion of length* appears when we compare straight lines extending perpendicularly to each other in the field of vision. This too is to be explained by the differences in the arrangement of the muscles which move the eye upward and downward as compared with those which move the eye outward and inward. The illusion consists in the fact that a vertical straight line is judged on the average $^1/_7$ to $^1/_{10}$ too long as compared with an equal horizontal line. A square, accordingly, appears as a rectangle whose base is shorter than its sides, and a square drawn by the eye is always too short in its vertical dimensions. As in the case of partially paralyzed eyes, so here in normal vision, distances in the direction of the more difficult movement appear greater.

Besides this difference between vertical and horizontal distances, which is most noticeable because it is so large, there are less marked differences between upward and downward and also between outward and inward distances. The upper half of a vertical line is overestimated on the average
3) by $^1/_{16}$ of its length, and the outer half of a horizontal line

by 1/40. The first of these illusions corresponds to the facilitation of downward movements (described p. 135), the second corresponds to the general facilitation of movements of convergence. variable illusions in length & dire

due to common attribu of move

20. In addition to these two constant illusions, which arise from the special structure of ocular muscles in their adaptation to the purposes of vision, there are certain other *variable optical illusions* which are due to certain attributes common to all our voluntary movements and which have their analogues in the movements of the tactual organs. These variable illusions may also be divided into those of *direction*, and those of *length*. The former follow the rule that acute angles are overestimated, obtuse angles underestimated, and that the direction of the lines forming the angles varies correspondingly. For the illusions of length we have the rule, that forced or interrupted movements require more exertion than free and continuous ones. Any straight line that necessitates fixation is, accordingly, overestimated in comparison with an open distance marked off by two points, and a straight line interrupted by several dividing lines is overestimated in comparison with an uninterrupted line. analogues facts of touch.

directi-

20 a. The tactual analogues of the illusion in visual angles is to be found in the tendency to overestimate small articular movements and to underestimate large ones. This comes under the general principle that a relatively greater expenditure of energy is required for a short movement than for a more extensive one, because it is relatively more difficult to begin a movement than to continue it after it is already started. The tactual phenomena analogous to the overestimation of interrupted lines, is that a distance estimated by a movement of one of the limbs always seems shorter when it is traversed in a single continuous movement, than it does when the movement is several times interrupted. Here too, the intensity of the sensation

ausality ? sensation

corresponds to the expenditure of energy, both being, of course, greater for an interrupted movement than for a continuous movement. The overestimation of interrupted lines by the eye takes place, as we can easily understand, only so long as no motives arise from the way in which the division is made, to hinder the movement of the eye over the interrupted line. Such a hindrance is present, for example, when the line is interrupted only once. This one point of division makes fixation necessary. If we compare such a line with a continuous one, we tend to estimate the first without any movement, the point of division being the fixation-centre, while the second is perceived by a movement of the eye. As a result the continuous line seems longer than the interrupted line.

Part played by asso

20b. All of these illusions of direction and length, whether variable or constant, are classified as "geometrical optical illusions", and are thus distinguished from certain other optical illusions which depend upon pure optical irregularities. The term geometrical is used because it is in the construction of geometrical figures that the best opportunities for the discovery of such illusions appear. The term is extended so as to cover not only these illusions which have been described and which depend upon the characteristics of eye movements, but also to include other unusual forms of visual space perception which are due to the laws of association to be discussed later. These latter we may distinguish by the special designation "association illusions". Such association illusions are exemplified by the fact that a given line when placed near a very much shorter line is overestimated, and, conversely, when placed near a long line the same given line is underestimated. Similar underestimation or overestimation appears in the case of an angle compared respectively with a larger and smaller angle. These facts are obviously analogous to the facts of light and color contrast (§ 17, 11). Similar associations appear in the variable illusions of direction and length described above in which the illusory figures due to differences in the energy of movement, were in each case brought into agreement with the retinal images by a projection of the flat figure into depth. Thus, for example, we not only see an interrupted straight line as longer than an uninterrupted line of equal length, but we also interpret the interrupted line as lying at a greater distance. This latter fact of interpretation depends upon the general rule of perception which has been established by a large number of associations, that of two objects casting retinal images of equal size the more remote is the larger. Such perspective association illusions appear more clearly in cases of rigid fixation than when the eye is moving freely, because such illusions depend very largely on the direct comparison of retinal images. They furnish also a means of distinguishing between variable illusions and constant illusions, for the constant illusions do not, as a rule, show any of these tendencies towards perspective interpretation. For further discussion of association illusions compare § 16, 9. For spacial contrast § 17, 11.

Distances in the field of vision not dependent on proximity of retinal elements to each other

21. Both the variable and the constant optical illusions point to the immediate dependence of the perception of spacial directions and distances on ocular movements. As further evidence pointing in the same direction, we have the negative fact that the arrangement of the retinal elements, especially their proximity to one another, normally has no appreciable influence on the ideas of direction and magnitude. This is most strikingly evident in the fact that the distance between two points appears the same whether observed in direct or indirect vision. Two points that are clearly distinguished in direct vision, may become *one* in the eccentric parts of the field of vision, but so soon as they are distinguished at all, they will appear just as far apart in one region as in the other, or if there is is any apparent difference, it is so uncertain and so variable that it to be entirely overlooked as bearing upon the main fact, in view of the very marked differences in the distribution of the sensitive elements at the centre and periphery of the retina. This fact that our perception of magnitude is independent of the proximity of the retinal elements holds even for a part of the retina that is not sensitive to light at all — for

the *blind spot*, where the optic nerve comes into the eye. Objects whose images fall on the blind spot are not seen. The size of this spot is about 6°, and it is located 15° inward from the point of fixation. Images of considerable size, as, for example, that of a human face at a distance of six feet, may disappear entirely on it. Still, when points appear at the right and left or below and above this region, we localize them just as far from each other as we should in any other, uninterrupted part of the field of vision. The same fact is observed when some part of the retina becomes blind through pathological conditions. The resulting break in the field of vision shows itself only in the fact that images falling on it are not seen, it never appears through any changes in the localization of objects lying on opposite sides of the blind region[1]. Two elements of space

22. The *keenness of vision* and the *perception of directions and distances in the field of vision*, are, as all these phenomena show, two different functions, which depend upon different conditions: the first depends *on the proximity of the retinal elements to one another*, the second *on ocular movements*. It follows directly that spacial ideas from sight can not be regarded as original ideas or ideas arising from light impressions in themselves, any more than the spacial ideas of touch can be referred directly to the tactual impressions themselves. The spacial order is in both cases developed from the combination of certain sensational components which,

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[1] In this connection we have the fact that the blind spot does not appear in the field of vision as a break, without sensational content, but as a continuation of the general brightness and color of the whole field. Thus, the field is seen as continuously white when we are looking at a white surface, as black when we look at a black surface. This filling out of the blind spot is possible only through reproduced sensations, and is to be considered as one of the phenomena of association to be discussed later (§ 16).

Retinal local signs [illegible]
demonstration of same.

taken separately, have no spacial attributes whatever. Other conditions also indicate that the elements are related in vision in the same way as in the case of touch, and that the development of visual space under normal conditions runs entirely parallel to the development of space in cases of congenital blindness, that is, under the only condition under which touch attains a similar independence. Retinal impressions correspond to impressions of contact, and ocular movements to touch movements. Tactual impressions can gain spacial qualities only through the local coloring of the sensations connected with them — the local signs — and in like manner, we must recognize the same to be true for retinal impressions.

Relation to touch.

22a. To be sure, a qualitative gradation of local signs on the retina can not be demonstrated with the same evidentness as for the skin. Still, by the use of colors it can be established in a general way that at relatively great distances from the retinal centre the sensational quality gradually changes. Colors are not so saturated in indirect vision, and the color-tone also changes; for example, yellow appears orange. There is, indeed, in these facts of retinal response no strict proof of the existence of pure local differences in the sensations, at least not in the fine gradations that must be assumed in the retinal centre. Still, the facts show that local differences in sensations do exist, and this seems to justify the assumption of such differences even beyond the limits of demonstration. This assumption is all the more justifiable because in vision where the gradations are much finer than in touch, the tendency to translate sensational differences directly into local differences, a tendency which has already been noticed in the case of touch, would certainly do much more to destroy the specifically qualitative character of these local differences. As a confirmation of this view we have the fact that the demonstrable sensational differences at greater distances from the retinal centre, can be observed only under favorable conditions, that is, when limited impressions are used;

they disappear entirely when surfaces of uniform color are looked at. This disappearance of marked qualitative differences must be attributed in part at least to their relation to local differences. General Theory of Special vision

23. We assume, accordingly, qualitative local signs, which, judging from the data derived from the keenness of vision, are graded in the finest stages at the retinal centre and more slowly in the eccentric parts. The formation of visual space may then be described as a combination of this system of local signs arranged in two dimensions, with a system of intensive inner tactual sensations. For any two local signs *a* and *b* there will be a corresponding sensation of strain α, arising from the movement through the distance *a b*, and serving as a measure of the same. A longer distance *a c* will have a more intense sensation af strain, γ. Just as the point of finest discrimination on the finger is the centre of reference, so in the same way the retinal centre is such a point of reference for the eye. In fact, this is, because of the laws of ocular movements, more obvious for the eye than it is for the tactual organ. Any luminous point in the field of vision is a stimulus for the centre of ocular innervation, and tends to turn the line of regard reflexly upon itself. This reflex relation of eccentric stimuli to the retinal centre is probably an essential condition for the development of the synergy of ocular movements mentioned above, and is, at the same time, an explanation of the great difficulty of observing objects in indirect vision. This difficulty is evidently due to the greater reflex impulse toward a point in indirect vision when the attention is concentrated upon it. As a result of the preeminent importance which the retinal centre has for ocular movements, the point of fixation necessarily becomes the centre of reference in the field of vision, and all distances in this field are brought under a unitary standard

by being determined with reference to the fixation-point. The excitation of local signs is due to the action of external impressions, and both together cause the movement towards the retinal centre. The whole process of visual space arrangement is thus due to the fusion of three different sensational elements: first, the sensational qualities depending upon the character of the external stimulus, second the qualitative local signs depending on the points upon which the stimuli act, and third, the intensive motor sensations determined by the relation of the stimulated points to the centre of the retina. The latter elements may either accompany actual movements — this is the original case — or, when the eye remains at rest, these elements are mere motor impulses of a particular intensity. Because of the regular connection between qualitative local signs and intensive sensations of strain which accompany the movements, the two factors may together be regarded as a single system of *complex local signs.* The spacial localization of a simple visual impression, is a product of a complete fusion of the sensation caused by the external stimulus with the two interconnected elements belonging to this system of complex local signs. The arrangement of a number of simple impressions in space consists in the combination of a great number of such fusions, which are graded in quality and intensity according to the elements of the system of local signs. The predominating elements in these fusions are the sensations due to the external stimulation. In comparison with these, the elements of the system of local signs are little recognized, because in the immediate perception of objects the local signs are entirely swallowed up in their spacial interpretation.

b. *The Location of Visual Ideas in Relation to the Ideating Subject.*

Point of orientation in binocular vision

24. The simplest case of a relation between an impression and the subject, which can appear in a visual idea, is evidently that in which the impression is limited in extent to a single point. If a single point of light is presented in the field of vision, both lines of regard are, as a result of the reflex impulse exerted by the stimulus (p. 142), turned upon it in such a way that in both eyes the images fall upon the retinal centres. Furthermore, the organs of accommodation are also adapted to the distance of the point. The point thus represented on the centres of both retinas is seen as *single*, and as situated in a certain particular direction, and at a certain particular distance from the ideating subject. Direction of line of orientation

The subject is represented, as a rule, by a point which may be defined as the middle point of the straight line connecting the centres of rotation of the two eyes. We will call this the *point of orientation* for the field of vision, and the straight line drawn from this point to the intersection of the two lines of regard, that is to the external fixation-point, we will call the *line of orientation*. When a point in space is fixated, there is always a fairly exact idea of the direction of the line of orientation. This idea is produced by the inner tactual sensations arising from the position of the two eyes. Such sensations are very noticeable because of their intensity, when the eyes are rotated much out of the central position. They are just as perceptible for a single eye, so that localization in direction is as perfect in monocular as in binocular vision. In monocular vision, however, the line of orientation generally coincides with the line of regard[1]).

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[1]) The habit of seeing with two eyes results in exceptions to

Idea of the length of the line of orienta

25. The idea of the *distance* of objects from the subject, or of the *absolute length* of the line of orientation, is much more indefinite than the idea of direction. We are always inclined to ideate this distance shorter than it really is, as may be shown by comparing it with a standard placed somewhere in the field of vision perpendicular to the line of orientation. In this way we find that the distance on the standard which is judged to be equal to the line of orientation, is always much shorter than the real length of this line. The discrepancy between the two increases as the point of fixation moves further away, that is, as the line of orientation becomes longer. The only sensational components that can produce this idea of distance, are the sensations of tention arising from the position of the two eyes. These sensations arise particularly from the convergence of the lines of regard and give somewhat of a measure of the absolute extent of this convergence. In fact, it is possible to observe sensations when the convergence is changed: from the inner angle of the eye when the degree of convergence is increased, from the outer angle when the convergence is decreased. The sum of all the sensations corresponding to a given position of convergence distinguishes such a position completely from all others.

Discrimination of

and

26. It follows that an idea of a definite, absolute length of the line of orientation can be developed only through experience, during which there appear, in addition to the sensational elements, a great many associations. This explains why these ideas always remain indefinite and why they are

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this rule. Often when one eye is closed, the line of orientation remains the same as in binocular vision and does not coincide with the line of regard. In such cases the closed eye usually makes the movements of convergence to a fixation point which is the same as that of the open eye.

sometimes aided, sometimes interfered with by other components of visual ideas, especially by the size of the retinal images of familiar objects. On the other hand, we have in the sensations of convergence, a relatively fine measure for *differences* in the distances of objects. For positions in which the lines of regard are nearly parallel, changes in convergence may be perceived that correspond to an angle of vision of 60″ or 70″. When the convergence increases, the absolute amount of this least perceptible change in convergence also increases considerably, but, in spite of this increase in angular amount, the corresponding differences in the length of the line of orientation become smaller and smaller. Thus the purely intensive sensations which accompany movements of convergence, are translated directly into ideas of changes in the distance between the fixation-point and the point of orientation of the subject.

This translation of a certain particular sensational complex into an idea of distance, is not due to any connate energy, but to a particular psychical development, as is shown by a great number of experiences. Among these is the fact that the perception both of absolute distances and of differences in distance, is greatly improved by practice. Children are generally inclined to localize very distant objects in the immediate neighborhood: they grasp at the moon, at the slater on the tower, etc. In the same way, it has been observed that the congenitally blind are, immediately after an operation, entirely unable to distinguish near and far.

Perception
Points at
Diff. Distance

27. It is of importance for the development of this discrimination between far and near, that under the natural conditions of vision, not mere isolated points are presented, but *extended three-dimensional objects*, or at least a number of points at different depths, to which we assign relatively different distances along their respective lines of orientation.

Let us consider first the simplest case, where *two* points a and b are presented, lying at different depths and connected by a straight line. A change in the fixation from a to b is always accompanied by a change in convergence, and brings about, first, the passage through a continuous series of retinal local signs corresponding to the points on the line $a\,b$, and, secondly, an inner tactual sensation, α, corresponding to the difference in convergence between a and b. This gives us the elements of a spacial fusion. The product of this fusion is, however, peculiar in kind; it differs in both its components, that is, in the successive series of local signs and in the concomitant tactual sensations of movement, from the fusions that arise when we view a line in the field of vision (p. 142), which does not extend in the third dimension, but lies entirely in a given plane. In the latter case the changes in local signs and sensations of movement are *alike* for both eyes, while in the former case, that is, in changing the point of fixation from far to near, or the reverse, the changes in local signs are opposite in the two eyes. For when the convergence gives the right eye a rotation towards the left, it will produce a rotation towards the right in the left eye, and vice versa. The same must also hold for the movement of the retinal images: when the image of the point as it leaves the point of fixation, moves towards the right in the right eye, it moves towards the left in the left eye, and vice versa. The first takes place when the eyes turn from a nearer to a more distant point, the latter, when they move in the opposite direction. Such fusions arising from movements of convergence have, so far as their qualitative and intensive components are concerned, a composition analogous to the fusion on which the arrangement of the elements in the field of vision with regard to one another depends; but the special way in which these elements are united is entirely different in the two cases. Theory of Binocular Ideas of the [illegible]

28. Thus, the fusions between local signs and inner tactual sensations form a system of *complex local signs* which is analogous to that described above (p. 142), but is in some respects unique in its composition. This second system of local signs adds to the reciprocal relation between the objective elements, a relation between the ideating subject and these elements. This relation to the subject divides into two ideational elements, characterized by distinctive sensational elements: the *idea of direction* and that of *distance*. Both refer primarily to the point of orientation in the head of the ideating subject, and are then secondarily applied to the relations of external objects in regard to one another. Thus, we come to assign to two points which lie at different distances along the line of orientation a certain direction and a certain distance in relation to each other. All such ideas of spacial distance of various positions along the line of orientation, when taken together make up what are called *ideas of depth*, or when they are also ideas of particular single objects *ideas of three-dimensional objects.*

[illegible] cond. ideas depth

29. An idea of depth arising in the way described varies according to objective and subjective conditions. The determination of the absolute distance of an isolated point in the field of vision, is always very uncertain. Even the determination of the relative distance between two points *a* and *b* lying at different depths is generally certain only under the conditions assumed above, namely, the conditions that the points are connected by a line along which the points of fixation for the two eyes can move in changing the convergence from one to the other. We may call such lines which connect different points in space with one another *lines of fixation.* The principle may then be formulated:

Influence of [illegible]

points in space are perceived in their true relations, only when they are connected by lines of fixation, along which the points of fixation of the two eyes may move. This principle is explicable on the ground that the conditions for a regular union of the local signs of the retina with sensations of strain that accompany convergence, are obviously fulfilled only when impressions are presented which can arouse on the retina local signs appropriate to the particular sensations of strain given through the convergence.

30. When the conditions mentioned are not fulfilled and there either arises an imperfect and indefinite idea of the differences in the relative distance of the two points from the subject, or else the two points seem to be equally distant — a phenomenon which can appear only when one of the points is rigidly fixated — there always arises in the idea another important change consisting in the fact that only the fixated point is seen as single, the other is seen as *double*. The same thing happens in looking at extended objects when they are not connected with the binocular fixation-point by means of lines of fixation. Double images that arise when the fixated point is nearer than the observed object, are *uncrossed* i. e., the right belongs to the right eye, the left to the left eye; they are *crossed* when the point of fixation is beyond the object.

Binocular
double
images
localization
in depth

Localization in depth

Binocular localization in depth and binocular double images are, accordingly, phenomena directly interrelated. Where localization is indefinite and imperfect we have double images, and where, on the other hand, double images are absent, the localization in depth is definite and exact. The two phenomena stand in such a relation to the line of fixation that, when such a line is present, it aids in forming the idea of depth and in doing away at the same time with double images. Still, this rule is not without exception, for when a point is rigidly fixated with both eyes, double images may arise in spite of any lines of fixation that may be present. This is explained by the general conditions mentioned above (p. 149) as necessary for ideas of depth. Just as the absence of lines of fixation results in the lack of the required succession of the local signs, so in a similar way the inner tactual sensations connected with movements of convergence are absent in rigid fixation.

c. *Relations between the Location of the Elements in Regard to one another and their Location in Regard to the Subject.*

ect Vision

31. When the field of vision is thought of merely as a series of *locations of visual impressions in relation to one another*, we represent this field to ourselves as a surface, and call the single objects lying in this surface *two-dimensional*, in contrast with those which have also depth. But even an idea of two dimensions must always be related to the seeing subject in two ways. For, in the first place, every point in the field of vision is seen in a particular *direction* on the subjective line of orientation mentioned above (p. 144), and secondly, the whole field of vision is localized at a more or less definite *distance* from the subject. The location in a particular direction results in an *erect* ideational object corresponding to an inverted retinal image. This relation between the objective localization in direction and the retinal image is as necessary a result of ocular movements, as the inversion of the image is a result of the optical properties of the eye. Our line of orientation in space is the *external* line of regard, or, for binocular vision, the middle line resulting from the combined effects of movements of fixation. A direction upward on this line of orientation in external space corresponds to a direction down-

ward in the internal ocular space where the retinal image lies, behind the centre of ocular rotation. And the converse is true for directions downward on the line of orientation.

32. The location at some distance or other, which also is never absent, results in the fact that all the points of the field of vision seem to be arranged on the *surface of a concave hemisphere* the centre of which is the point of orientation, or, in monocular vision, the centre of the eye's rotation. Now small areas of a large curved surface appear plane, so that the two-dimensional ideas of single objects are as a rule *plane*; thus, for example, figures drawn upon a plane, such as those of plane geometry. But as soon as some parts of the general field of vision separate from this field in such a way that they are localized before or behind, that is in different planes, the idea of two dimensions gives place to one of three.

Complex local signs of depth & binocular parall

32a. The fusions formed between qualitative local signs and inner tactual sensations when we change from the fixation of a more distant point to the fixation of a nearer, or the reverse, may be called *complex local signs of depth*. Such local signs form for every series of points lying before or behind the fixation-point, or for every extended body which is nothing but a series of such points, a regularly arranged system in which a stereometric series of points located at a particular distance is always unequivocally represented by a particular group of complex local signs of depth. When one of two points lying at different distances is fixated, the other is represented in a definite and unequivocal manner by the positions of its images in the two eyes, which positions with their corresponding complex local signs are different in the two eyes. The same is true of connected series of points or extended bodies. When we look at a solid object, it throws images in the two eyes that are different from each other on account of the different relative positions of the object with reference to the two eyes. We designate the difference between the positions of a certain point in the image in the two eyes as the *binocular parallax*. This parallax is zero for the point fixated and for those points which are equally distant on the line of orientation; for all other points it has some real positive or negative value according as such points are more or less distant than the fixation-point. If we fixate solid objects with both eyes, only the point fixated, together with those points which are equidistant and in its neigborhood in the field of vision, will give rise to images corresponding in position in the two eyes. All points of the object located at different distances, give images varying in position and size. These differences in the images are just what produce the idea of the solidity of the object when the proper lines of fixation are present. For in the way above described, the angle of binocular parallax for the image of any point lying before or behind the point of fixation and connected with the same by a line of fixation, furnishes, according as the direction and magnitude of the parallax varies, a measure of the relative distance of this point in depth. This measure it furnishes through the complex local signs connected with the angle of parallax. This angle of parallax for a given objective depth, decreases as the distance of the solid object from the subject increases, so that the impression of solidity diminishes, the further off the objects are, and when the distance is so great that all angles of parallax disappear, the body will appear flat, unless the associations to be discussed later (§ 16, 9) produce an idea of depth.

The Stereoscope

33. The influence of binocular vision on the idea of depth may be investigated experimentally by means of a *stereoscope*. This instrument consists of two prisms with their angles of refraction turned toward each other in such a way that it renders possible a binocular combination of two plane drawings which correspond to the two retinal images from a three-dimensional object. The influence of the various conditions that underlie the formation of ideas of depth, may, in this way, be studied much better than by looking

at actual three-dimensional objects, for in the stereoscope we may vary the conditions at will.

To give a concrete illustration, it is observed that complex stereoscopic pictures generally require several movements of convergence back and forth before a clear plastic idea arises. Furthermore, the effect of the parallax appears in looking at stereoscopic pictures the parts of which are movable in respect to each other. Such movements are always accompanied by changes in the relief which answer exactly to the changes in binocular parallax. This parallax is dependent on the distance of the two eyes from each other, so that ideas of depth can be produced even in the case of objects too distant in reality to give a plastic effect. Plastic effect is secured in such cases by combining in the stereoscope, pictures taken from positions much further apart than the two eyes. This is done, for example, in making stereoscopic photographs of landscapes. The result is that these photographs when combined, do not look like real landscapes, but like plastic models regarded from a short distance. Monocular

of depth

34. In monocular vision all the conditions which are connected with movements of convergence are absent. There are, furthermore, no binocular differences in the retinal images such as may be artificially reproduced in the stereoscope. But even here not all the influences are wanting to produce a localization in the third dimension, although this localization is more imperfect. Influence of accommodati

The direct influence of *movements of accommodation* is, in comparison with other conditions, relatively small. Still, like movements of convergence, movements of accommodation are also accompanied by sensations which can be clearly perceived in the case of greater changes of accommodation from distant, to neighboring points. For smaller changes in depth these sensations are very uncertain. As a result the movement of a point in the direction of the line of regard, when it is looked at with only one eye, is generally not clearly observed until a change in the size of the retinal image appears. Elements of Perspective

35. For the development of monocular ideas of depth the influences which the components of the so-called *perspective* exercise, are of the greatest importance. These are the relative magnitude of the angle of vision, the direction of limiting lines, the direction of shadows, the change in colors due to atmospheric absorption, etc. All these influences, depend on *associations of ideas,* and will, therefore, be treated in a later chapter (§ 16).

Survey & criticism of these theories

35a. We have in general the same opposing theories for the explanation of visual ideas as for tactual ideas (p. 125). The *empirical* theory has sometimes committed the fallacy of limiting itself to optics and turning the real problem of space perception over to touch. In such cases it has tried to explain only how a localization of visual ideas can take place with the aid of experience, on the basis of already existing spacial ideas from touch. Such an interpretation is, however, not only self-contradictory, but it also conflicts with experience, which shows that in normal persons with vision, visual space perception determines tactual, not the reverse (p. 115). The fact of general development, that touch is the more primitive sense, can not be applied to the development of the individual. The chief evidences in support of *nativistic* theories are, first, the metamorphopsia after dislocation of retinal elements (p. 132) and, secondly, the position of the line of orientation (p. 144), which indicates united functioning of the two eyes from the first. It has been noted already (p. 132) that the metamorphopsia and other related phenomena prove the exact opposite as soon as the changes to which they are due become stationary. Furthermore, the fact that in long continued use of only one eye the line of orientation comes to coincide with the line of regard (p. 144), proves that the position of this line is not given from the first, but that it has arisen under the influence of the conditions of vision. Still another fact against the nativistic and in favor of the genetic theory, is the development in the child of the synergy of ocular movements under the influence of external stimuli and the organization of space perceptions which apparently accompanies it. Here as in many other respects the development of most animals is different. In animals the reflex connections of retinal impressions with movements of the eyes and head, function perfectly immediately after birth (v. inf. § 19, 2).

The *fusion theory* has gained the ascendency over older nativistic and empirical views, chiefly through the more thorough investigation of the phenomena of *binocular vision.* Nativism has difficulty with the question why we generally see objects single although they produce images in each of the two eyes. The effort is made to avoid the difficulty by assuming that two identical retinal points are connected with the same optic fibre which divides in the chiasma, and that in this way the two retinal points represent what in the sensorium is only a single point. This doctrine of the "identity of the two retinas" became, however, untenable as soon as the actual conditions of binocular vision in three dimensions began to be investigated.

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§ 11. TEMPORAL IDEAS.

The attributes of

1. All our ideas are at once spacial and temporal. But just as the conditions for the spacial arrangement of impressions belong originally to the tactual and visual senses, and just as spacial relations are only secondarily carried over from these to all other sensations, so there are only *two* kinds of sensations, namely, the inner tactual sensations from movements and the auditory sensations, which are primary sources of temporal ideas. Still, there is a characteristic difference between spacial and temporal ideas in the fact that in the case of spacial ideas the two senses mentioned are the only ones which can develop an independent spacial order, while in the case of temporal ideas the two most important kinds of sensation are merely those in which the conditions are most favorable for the rise of temporal ideas. These conditions are not entirely wanting in any sensations. This indicates that the psychological basis of temporal ideas is *more general*, and that it is not determined

by the special structures of particular sense organs. In agreement with this view is the fact that we attribute to subjective processes, such as feelings and emotions, the same temporal attributes as we attribute to ideas. It is to be noted, however, that no justification for the conclusion that time perception is in itself a more universal form of perception, is to be found in this fact that the conditions of time perception are more general than are those of space perception. In the same way that we carry over spacial attributes from the two senses that give us space perception to other kinds of sensations, so also we give spacial attributes secondarily to feelings and affective processes, through the sensations and ideas inseparably connected with them. It may with equal right be doubted whether affective processes in themselves, without their related ideas, would have temporal attributes, for among the conditions of a temporal order are certain attributes of the sensational elements of ideas. The real facts in the case are that all psychical contents, are at once spacial and temporal. The spacial order arises from certain particular sensational elements: in normal cases where vision is present from visual impressions, in blindness, from tactual impressions. Time ideas, on the other hand, can arise from all possible sensations.

Characteriz
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Spacial
order

2. Temporal compounds like spacial, and in contrast to intensive ideas, are characterized by the definite, unchangeable order of their component elements. If this order is changed, the given compound becomes another, even though the quality of its components remains the same. In spacial ideas, this unchangeableness of the order refers only to the relation of the elements to one another, not to the relation of the elements to the ideating subject. In temporal compounds, on the other hand, when the relation of one element is changed with respect to other elements, it is at the same

Intensive - in wh. every element b connec
and every other in same way.

time changed with respect to the ideating subject. There is no change of position in time analogous to that possible in the case of space compounds.

Form of temporal ideas & their names

2a. This property of the absolute, strictly speaking unchangeable, relation with respect to the ideating subject which belongs to every temporal compound, and every time element, however short, is what we call the *flow of time*. Every moment in time filled by any content whatever, has, on account of this flow, such a relation to the ideating subject that no other moment can be substituted for it. With space the case is just reversed: the very possibility of substituting any spacial element in its relation to the subject for any other element whatever, is what gives rise to the percept of *constancy*, or absolute duration, as we express it, by applying a time idea to a space idea. The idea of *absolute* duration, that is, of time in which no change takes place, is strictly speaking impossible in time perception itself. The relation to the subject must change continually. We speak of an impression as lasting, when its single periods in time are exactly alike so far as their *sensational contents* and *affective contents* are concerned, so that they differ *only in their relation to the subject*. The concept of duration when applied to time is, therefore, a merely relative concept. One time idea may be more lasting than another, but no time idea can have absolute duration. Even an unusually long unchanging sensation can not be retained. We interrupt it continually with other sensational and affective contents.

We may, however, separate the two temporal relations always united in actual experience, namely, that of the elements to one another, and that of the elements to the ideating subject, since each relation is connected with certain particular attributes of time ideas. In fact, this separation of the two relations found its expression in special terms for certain forms of occurrence in time, even prior to an exact psychological analysis of time ideas. If the relation of the elements to one another is alone attended to, without regard to their relation to the subject, *temporal modes* come to be discriminated, such, for example, as brief, long, regularly repeating, irregularly changing, etc. If, on the contrary, the relation of the subject is attended to, and the objective forms of occurrence neglected, we have as the chief forms of this relation the *temporal stages*, past, present, and future.

A. TEMPORAL TOUCH IDEAS.

Relation of the mechani attribu of the lim to tempor ideas.

3. The original development of temporal ideas belongs to touch. Tactual sensations, accordingly, furnish the general substratum for the rise of both the spacial and temporal arrangements of ideational elements (p. 115, 3). The spacial functions of touch, however, come from the *outer* tactual sensations, while the *inner* touch sensations which accompany movements are the primary contents of the earliest temporal ideas.

The *mechanical* properties of the limbs are important physiological bases for the rise of these ideas. The arms and legs can be moved in the shoulder-joints and hip-joints by their muscles, and are at the same time subject to the action of gravitation drawing them downward. As a result there are two kinds of movements possible for these extremities. First, we have movements which are continually regulated by voluntary activity of the muscles and may, therefore, be indefinitely varied and accommodated at every moment to existing needs — we will call these the arhythmical movements. Secondly, we have movements in which the voluntary energy of the muscles is operative only so far as it is required to set the limbs oscillating in their joints and to maintain this movement — *rhythmical* movements. We may neglect for our present consideration the arhythmical movements exhibited in the various uses of the limbs. Their temporal attributes are in all probability derived from the rhythmical movements, and only a very indefinite comparison of the duration of irregular movements is possible.

Rhythmical tactual movement

4. With rhythmical movements the case is different. Their significance for the psychological development of time ideas is due to the same principle as that which gives them their importance as physiological organs, namely, the principle of *the isochronism of oscillations of like amplitude*. In walking, the regular oscillations of our legs in the hip-joints not only reduce the amount of the muscular energy expended, but also reduce to a minimum the continual voluntary control of the movements. Furthermore, in natural walking the arms are supplementary aids. Their oscillation is not interrupted at every step as is that of the legs by the placing of the foot on the ground, so that they furnish, because of the continuity of their movement, a means for the more uniform regulation of the whole action.

Every single period of oscillation in such a movement is made up of a continuous succession of sensations which are repeated in the following period in exactly the same order. The two limits of the period are marked by a complex of *outer* tactual sensations: the beginning by the impression accompanying the removal of the foot from the ground, the end by the impression accompanying the return of the foot to the ground. Between these there is a continuous series of weak inner tactual sensations from the joints and muscles. The beginning and end of this series of inner sensations coincide in time with the appearance of outer sensations, and are more intense than the intermediate internal sensations. These more intense internal sensations accompany the impulse of movement coming to the muscles and joints and the sudden inhibition of these impulses, and they assist much in marking off the successive periods.

Connected with this regular succession of sensations is a regular and exactly parallel series of *feelings*. If we consider a single period in a series of rhythmical movements, there is always at its beginning and end a feeling of *fulfilled expectation.* Between the two limits of the period there is, beginning with the first movement, a gradually growing feeling of *strained expectation*, which suddenly sinks at the last moment from its maximum to zero, and gives place to the rapidly rising and sinking feeling of fulfillment. From this point on the same series is again repeated. Thus, the whole process of a rhythmical touch movement consists, on its affective side, of a succession of two qualitatively antagonistic feelings. In their general character these feelings belong to the series of straining and relaxing feelings (p. 92). One of these feelings is very rapid in its course, the other gradually reaches a maximum and then suddenly disappears. As a result, the most intense affective processes are crowded together at the extremities of the periods, and are made all the more intense through the contrast between the feeling of satisfaction and the preceding feeling of expectation. Just as this sharply marked limit between the different periods has its sensational substratum in the strong outer and inner tactual impressions arising at this instant, as above pointed out, so there is also a complete series of feelings of expectation corresponding to the continuous series of weaker inner tactual sensations accompanying the oscillatory movements of the limbs.

Tactual Ideas + feet

5. The simplest temporal ideas of touch are made up of the rhythmically arranged sensations which, when like oscillatory movements are repeatedly carried out, follow one another with perfect uniformity in the manner described. But even in ordinary walking a slight tendency towards a somewhat greater complication arises. The beginning of the first of two successive periods is emphasized, both in the sensation and in the accompanying feeling, more than the beginning of the second period. In this case the rhythm of

movement begins to be *metrical.* A simple regular succession of accented and unaccented ideas corresponds to the simplest measure, $^2/_8$-time. It arises easily in ordinary walking because of the physiological superiority of the right side, and appears very regularly when several persons are walking together — in *marching.* In the latter case even more than two periods may be united into one rhythmical unit. The same is true of the complicated rhythmical movements of the *dance.* But in such composite tactual rhythms the auditory temporal ideas have a decided influence.

[illegible] attributes of auditory sense

B. TEMPORAL AUDITORY IDEAS.

6. The attribute of the auditory sense which most of all adapts it to the more accurate perception of the temporal relations in external processes, is the exceedingly short persistence of its sensations after the cessation of the external stimulation, as a result of which any temporal succession of sounds is reproduced with almost perfect fidelity in the corresponding succession of sensations. Connected with this fact are certain psychological properties of temporal auditory ideas. In the first place, temporal auditory ideas differ from temporal ideas of touch in that often only the extremities of the single intervals that go to make up the total idea, are marked by sensations. In such a case the relations of such intervals to one another are estimated by means of the apparently empty or heterogeneously filled intervals that lie between the limiting sensations.

[illegible] of Rhythms

This is especially noticeable in the case of *rhythmical* auditory ideas. There are in general *two* possible forms of such ideas; *continuous*, or only rarely interrupted successions of relatively lasting sensations, and *discontinuous* successions of strokes, in which only the extremities of the rhythmical periods are marked by external sounds. For a discontinuous succession of entirely uniform sounds the temporal attributes of the ideas are in general more apparent than for lasting impressions, since in the former case any effects from the tonal qualities as such are entirely obviated. We may confine our consideration to discontinuous series, because the principles that apply here hold for continuous successions also. In fact, the rhythmical division in the latter case, is made by means of certain single accents which are either given in the external impression or voluntarily applied to it.

7. A series of regular strokes made in this way as the simplest form of temporal auditory ideas, as for example, a series of ticks of a clock or of a metronome, is distinguished from the simplest form of temporal touch ideas, described above (p. 161), mainly by the absence of all *objective* sensational content in the intervals. The external impressions here do nothing but divide the separate intervals from one another. Still, the intervals of such a series are not entirely empty, they are filled by subjective affective and sensational contents which correspond fully to those observed in tactual ideas. Most emphatic of all are the *affective contents* of the intervals consisting of successive periods of expectation. This expectation gradually rises in each period and is at the end of such a period suddenly fulfilled. Even the sensational substratum for this feeling is not entirely absent; it is merely more variable. Sometimes it is nothing but the sensations of tension of the tympanic membrane, in their various intensities. Then again, in those cases in which an involuntary rhythmical movement is connected with the auditory series, it is the accompanying sensations of tension from other organs, or finally, it is a series of some other kind of inner tactual sensations.

Analysis of simpl idea beat

Influence of the mode of present tempor on idea of beat

The influence of the subjective elements on the character of time ideas shows itself most clearly in the case of the rhythmical auditory impressions in the effect produced by *different rates of succession* of the sensations. A certain medium rate of about 0.2 sec. is found to be most favorable for the union of a number of successive auditory impressions, and it is easy to observe that this is the rate at which the above mentioned subjective sensations and feelings are most pronounced in their alternation. If the rate is made much slower, the strain of expectation is too great and passes into an unpleasurable feeling which becomes more and more unendurable. If, on the contrary, the rate is accelerated, the rise of the feeling of expectation is interrupted so soon that the feeling is barely noticeable. Thus, in both directions, limits are approached at which the synthesis of the impressions into a rhythmical time idea is no longer possible. The upper limit is about one second, the lower about 0.1 sec.

Changes in the Rhy. perception thro' varia
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8. Then again, this influence of the course of our sensations and feelings upon our perception of temporal intervals, shows itself just as clearly in the changes that our ideas of such an interval undergo when the conditions of perception are varied without changing the objective length of the interval. Thus, it has been observed that in general a period divided into intervals is estimated as longer than one not so divided. We have here a phenomenon analogous to that observed in the illusion with interrupted lines (p. 137). The overestimation is always much greater for temporal intervals. This is obviously due to the fact that the oft repeated alternations of sensations and feelings in an interval of time have a greater influence than the interruption of the movement through points of division in the case of the similar space-illusion. Furthermore, if in a series of regular beats, single impressions are emphasized by their greater intensity or by some qualitative peculiarity, the result is al-

ways that the intervals preceding and following the emphasized impression are overestimated in comparison with the other intervals of the same series. If, however, a certain rhythm is produced successively with weak and then with strong beats, the rate appears slower in the first case than in the second.

These phenomena are also explicable from the influence of the sensational and affective changes. An impression different from the rest, produces a change in the course of the sensations, and especially in the course of the feelings which precede its apprehension, for there must be a more intense strain of expectation and a correspondingly stronger feeling of relief or satisfaction. The feeling of expectation lengthens the interval preceding the impression, the feeling of relief that following. The case is different when the whole series is made up at one time of weak impressions, and at another of strong ones. In order to perceive a weak impression we must concentrate our attention upon it more. The sensations and feelings of tension are, accordingly, more intense, as may be easily observed, for weaker beats than for stronger ones. Here too, then, the different intensities of the subjective elements that give rise to the temporal ideas are reflected in the differences between these ideas. The effect is, therefore, not only lost, but even reversed, when we compare, not weak beats with strong, but strong beats with still stronger beats.

Subjective conditions of
Rhythm
[illegible]
ide

9. The tendency found in the case of rhythmical touch ideas for at least *two* like periods to unite and form a regular metrical unit, shows itself in auditory ideas also, only in a much more marked degree. In tactual movements, where the sensations that limit the single periods are under the influence of the will, this tendency to form a rhythmical series shows itself in the *actual* alternation of weaker and

stronger impressions. With auditory sensations, on the other hand, where the single impressions can be dependent only on external conditions, and are, therefore, objectively exactly alike, this tendency may lead to the following characteristic illusion. In a series of beats which are exactly alike in intensity and are separated by equal periods of time, certain single beats, occurring at regular intervals, are always heard as stronger than the others. The rhythm that most frequently arises when there is nothing to determine it, is that known as $^2/_8$-time, that is, a regular alternation of arses and theses. A slight modification of this, the $^3/_8$-time, where *two* unaccented beats follow one accented beat, is also very common. This tendency to mark time can be overcome only by an effort of the will, and then only for very fast or very slow rates, where, from the very nature of the series, the limits of rhythmical perception are nearly reached. For medium rates, which are especially favorable to the rise of rhythmical ideas, a suppression of this tendency toward rhythmical arrangement for any length of time is hardly possible. If the effort is made to unite as many impressions as possible in a unitary time idea, the phenomena become more complicated. We have accents of different degrees which alternate in regular succession with unaccented members of the series and thus, through the resulting divisions of the whole into groups, the number of impressions that may be comprehended in a single idea is considerably increased. The presence of two different grades of accent gives $^3/_4$-time and $^5/_8$-time, the presence of three grades gives $^4/_4$-time and $^6/_4$-time, and as forms with three feet there are $^9/_8$-time and $^{12}/_8$-time. More than three grades of accentuation or, when the unaccented note is counted, more than four grades of intensity, are not to be found in either musical or poetical rhythms, nor can we produce more by voluntary formation of rhythmical ideas.

Obviously, these *three grades of accentuation* mark the limits of the *possible complexity* of temporal ideas, in a way analogous to that in which the maximal number of included impressions (§ 15, 6) marks the limits of the *length* of temporal ideas.

The phenomena of subjective accentuation and the influence of this accentuation on the sensations that go to make up the rhythms, show clearly that temporal ideas, like spacial ideas, are not derived from objective impressions alone, but that there are always connected with these, *subjective* elements which help by their character to determine the mode of apprehending the objective impressions. The primary cause of the accentuation of a particular impression is always to be found in the increase in the intensity of the preceding and concomitant feelings and inner tactual sensations of movements. This increase in the intensity of the subjective elements is then carried over to the objective impression, and makes the latter also seem more intense. The strengthening of the subjective elements may be *voluntary*, when the tension of the muscles which produce inner tactual sensations is voluntarily intensified, thus producing a corresponding intensification in the feeling of expectation. Or the strengthening of the subjective elements may be *involuntary*, when a grouping of the elements of the temporal idea is brought about as an immediate consequence of the fluctuations in sensation and feeling that take place during the effort to include as many factors as possible in the percept.

[illegible] of temporal ideas

C. GENERAL CONDITIONS FOR TEMPORAL IDEAS.

10. If we seek to account for the rise of temporal ideas on the basis of the phenomena just discussed, we must start with the fact that a sensation thought of by itself can no

more have temporal than it could have spacial attributes. Position in time can be possible only when single psychical elements enter into certain characteristic relations with other such elements. This condition holds for temporal ideas just as much as for spacial ideas. The nature of the union is, however, characteristic and essentially different for the two kinds of ideas.

The members of a temporal series $a\ b\ c\ d\ e\ f$, can all be immediately presented as a single whole, when the series has reached f, just as well as if they were a series of points in space. In the case of a spacial idea, however, the elements would, on account of original ocular reflexes, be arranged in relation to the point of fixation, and this fixation point could, at different times, be any one of the impressions a to f. In time ideas, on the other hand, it is always the *impression of the present moment* in relation to which all the rest are arranged in time. When a new impression becomes, in a similar manner, the present impression, even though its sensational contents are exactly the same as that of the earlier idea, still, it will be perceived as *subjectively* different, for though the affective state accompanying a sensation may, indeed, be related to the feelings of another moment, the two can never be identical. Suppose, for example, that following the series $a\ b\ c\ d\ e\ f$, there is a second series of impressions, $a'\ b'\ c'\ d'\ e'\ f'$, in which $a' = a$, $b' = b$, $c' = c$, etc., so far as their sensational elements are concerned. Let us represent the accompanying feelings by $\alpha\ \beta\ \gamma\ \delta\ \varepsilon\ \varphi$ and $\alpha'\ \beta'\ \gamma'\ \delta'\ \varepsilon'\ \varphi'$. Then α and α', β and β', γ and γ', etc., will be similar feelings, because the sensations are the same; but they will not be identical, because every affective element depends, not only upon the sensation with which it is immediately connected, but also upon the state of the subject as determined by the totality of its experiences. The state of the subject is different for each of the members of the series $a' \ b' \ c' \ d' \ldots$, than it was for the corresponding member of the series $a \ b \ c \ d \ldots$, because when the impression a' arrives, a has already been present, and so a' can be associated with a, while no such thing was possible in the case of a. Analogous differences in the affective states show themselves in composite series when repeated. These states are never identical, however much the subjective conditions of the momentarily present feelings may agree, for every one of them has its characteristic relation to the totality of psychical processes. If we assume, for example, a succession of a number of similar series $a \ b \ c \ d$, $a' \ b' \ c' \ d'$, $a'' \ b'' \ c'' \ d''$, etc., in which a equals a' and a'', b equals b' and b'', etc., so far as their sensational contents are concerned, still, a'' differs from a' in its affective conditions, for a' can be associated only with a, while a'' can be associated with both a' and a. Besides this, it is true that other differences between impressions alike in themselves always arise from some chance accompanying sensations which influence the affective state. Inner fixation point

11. Since every element of a temporal idea is, as above remarked, placed in some fixed relation to the impression immediately present, it follows that this present impression will have an attribute which makes it more prominent than any of the other elements of the same idea. This attribute is similar to that possessed by the *point of fixation* in the field of vision, or by the central points of the tactual surfaces, and consists in the fact that the present impression is the most *clearly* and *distinctly* perceived of all the elements of the idea. But there is a great difference in that this most distinct perception in the temporal idea is not connected with the physiological organization of the sense-organ, but is due entirely to the general attributes of the ideating

subject, as expressed in the affective processes. The momentary feeling accompanying the immediately present impression is what helps to make it the impression most clearly perceived. We may, accordingly, call the part of a temporal idea which forms the immediate impression the *fixation-point of the idea* or in general, since it does not depend on external structure, as does the fixation-point of spacial ideas, we may call it figuratively the *inner fixation-point*. The impressions that lie outside this point of fixation, that is, impressions that have preceded the present, are *indirectly* perceived. They are arranged in a regular gradation of diminishing degrees of clearness, from the fixation-point. A unitary temporal idea is possible only so long as the degree of clearness of each of its elements has some positive value. When the clearness of any element sinks to zero, the idea divides into its components. Continuous flow of the inner

12. The inner fixation-point of temporal percepts differs essentially from the outer fixation points of spacial percepts in that its character is primarily determined, not by sensational, but by *affective elements*. Since these affective elements are continually changing, in consequence of the varying conditions of psychical life, the inner fixation-point is also always changing. This change of the inner fixation-point is called the *continuous flow* of time. By the phrase continuous flow we mean to express the fact that no moment of time is like any other, and that no such moment can return (cf. sup. p. 158, 2 a). This fact is connected with the one-dimensional character of time, which is due to this very condition that the inner fixation-point of temporal ideas is continually moving forward, so that a single point can never recur. The arrangement of time in one dimension, with reference always to a changing point of fixation in which the subject represents himself, is what gives rise to the result

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that the elements of time ideas have a fixed relation, not only with respect to one another, but also with respect to the ideating subject (p. 157, 2). Gen. Theory of Temp. Ide

13. If we try to give an account of the means through which this reciprocally interdependent order of the parts of an idea, and the determination of these parts with reference to the ideating subject, originate, it is obvious that these means can be nothing but certain of the elements connected with the idea itself, which elements, however, considered in themselves, have no temporal attributes, but gain such attributes through their union. We may call these elements *temporal signs*, after the analogy of local signs. The characteristic conditions for the development of temporal ideas indicate from the first that these temporal signs are, in the main, *affective elements*. In the course of any rhythmical series every impression is immediately characterized by the concomitant feeling of expectation, while the sensation is of influence only in so far as it arouses the feeling. This may be clearly perceived when a rhythmical series is suddenly interrupted. Furthermore, the only sensations that are never absent as components of all time ideas are the *inner tactual sensations*. In the case of tactual time ideas these inner tactual sensations fuse immediately with the tactual sensations which arise from the movements of the part of the body in action, while in auditory and other ideas that are brought into the time form, they stand out distinctly from the other outer impressions as subjective accompanying phenomena. We may, accordingly, regard the feelings of expectation as the *qualitative temporal signs*, the inner tactual sensations described, as the *intensive*, *temporal signs* of a temporal idea. The idea itself must then be looked upon as a fusion of the two kinds of temporal signs with each other and with the objective sensations arranged in the tem-

Tempor

Signs

poral form. Thus, the inner tactual sensations, as a series of intensive sensations, give a uniform measure for the arrangement of the objective sensations; the accompanying feelings, on the other hand, furnish the qualitative characteristics of these impressions which are necessary for the temporal ideas.

Geom. representations of time

13a. The inner tactual sensations play a similar part in the formation of both time ideas and space ideas. This common sensational substratum leads very naturally to a recognition of a relation between these two forms of perception, which finds its expression in the *geometrical* representation of time by a straight line. Still, there is an essential difference between the complex system of temporal signs and the systems of local signs in the fact that the former is based primarily, not on the qualitative attributes of sensations connected with certain special external sense-organs, but on *feelings* which may come in exactly the same way from the most widely differing kinds of sensation, for these feelings are not dependent on the objective content of the sensations, but on their subjective synthesis. The marked variations in the conditions that control the course of these feelings explain, furthermore, why it is that our time ideas are very much less certain than our space ideas. The influence of the particular course of the feelings in any given case shows itself in the fact that the degree of certainty of any subjective estimation of a time interval depends primarily on the duration of the interval. Our comparison of temporal quantities, as, for example, in the case of successive rhythmical periods, is most accurate, other things being equal, for those intervals which are most favorable in point of length for rhythmical division. This favorable interval is, in the case of auditory sensations about 0.2 seconds (7). It may be observed when such an interval is given that the exactness of perception is conditioned by the favorable succession of feelings of expectation and fulfillment. Such a favorable succession makes it possible to recognize with greatest certainty when a new impression interrupts the feeling of expectation before it has risen to the same intensity as in a preceding case, or when, on the other hand, the new impression has, by its delay, allowed the feeling to reach a higher degree of intensity. When the succession of impressions is very slow the feelings of expectation become excessively intense. When, on the other hand, the succession is very rapid, it is almost possible to notice a feeling of surprise accompanying every impression. Even this feeling of surprise, however, can reach only a moderate intensity because of the relatively small degree of intensity attained by the preceding feelings of tension. For the facts of time memory compare § 16.

Nativistic & genetic theories.

13b. Here again we have on the question of the psychological origin of time ideas the same opposed *nativistic* and *genetic* theories which we had in the case of spacial ideas (p. 125, 12a). In this case, however, nativism has never developed a theory in any proper sense. It usually limits itself to the general assumption that time is a "connate form of perception", without attempting to give any account of the influence of the elements and conditions of temporal ideas which can be actually demonstrated. The genetic theories of older psychology, as, for example, that of HERBART, seek to deduce time perception from ideational elements only. This is, however, pure speculation and loses sight of the conditions given in actual experience.

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§ 12. COMPOSITE FEELINGS.

affective proce
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1. In the development of temporal ideas it appears clearly that the discrimination of sensational and affective components in immediate experience is purely a product of abstraction.

For time ideas the abstraction proves impossible, because, in this case, certain feelings play an essential part in the rise of the ideas. Time ideas may, therefore, be called *ideas* only when the final results of the process, that is, the arrangement of certain sensations in relation to one another and to the subject, are considered. When their real composition is looked into, they are complex products of sensations and feelings. They are thus to a certain extent transitional forms between ideas and those other psychical compounds which are made up of affective elements, and are designated by the general name *affective processes.* Affective processes resemble time ideas especially in the impossibility of an abstract separation of their affective elements from their sensational elements in any investigation of their rise. This impossibility of abstract separation is due to the fact that in the development of all kinds of affective processes, sensations and ideas are included as determining factors.

haracter

2. *Intensive affective combinations*, or *composite feelings*, must be the first affective processes discussed, because in them the characteristic attributes of the single compound are the products of a momentary state. The description of the feeling, therefore, requires only the exact comprehension of the momentary condition, not a comprehension at once of several processes occurring in time and proceeding from one another. There are, on the other hand, certain relatively permanent combinations of such feelings which appear not infrequently. Such permanent combinations we call *moods.* These moods frequently pass into emotions and thus may be looked upon as lying on the boundary line between feelings and emotions. Such boundary forms must be classified, because of their relatively permanent character, under the composite feelings.

3. Composite feelings, then, are intensive states of unitary character in which single simple affective components are to be perceived. We may distinguish in every such feeling, *component feelings* and a *resultant feeling*. The fundamental component feelings are always simple sense-feelings. Several of these may unite to form a partial resultant which enters into the whole as a compound component.

Every composite feeling may, accordingly, be divided, 1) into a *total feeling* made up of all its components, and 2) into single *partial feelings* which go to make up the total feeling. These partial feelings are in turn of different grades according as they are simple sense-feelings (partial feelings of the first order) or feelings which are themselves composite (partial feelings of the second or higher orders). Where we have partial feelings of higher orders, complicated combinations or *interlacings* of the component elements may take place. A partial feeling of lower order may, at the same time, enter into several partial feelings of higher order. Such interlacings may render the nature of the total feeling exceedingly complicated. The whole may sometimes change its character, even when its elements remain the same, according as one or the other of the possible combinations of partial feelings predominates.

Exemplification with musica cmpd clang

3a. Thus, the musical chord *c e g* has a corresponding total feeling of harmony, the fundamental elements of which, or partial feelings of the first order, are the feelings corresponding to the single clangs *c*, *e*, and *g*. Between these two kinds of feeling stand, as partial feelings of the second order, the three feelings of harmony from the double clangs *c e*, *e g*, and *c g*. The character of the total feeling may have four different shades according as one of these partial feelings of the second order predominates, or all are equally strong. The cause of the predominance of one of these complex partial feelings may be either the greater intensity of its sensational components, or the influence of preceding feeling. If, for example, *c e g* follows $c^{\flat}$ *e g* the effect of *c e* will be intensified, while if *c e g* follows *c e a* the same will hold for *e g*. Similarly, a number of colors may have a different effect according as one or the other partial combination predominates. In the last case, however, because of the extensive arrangement of the impressions, the spacial proximity has an influence antagonistic to the variation in the manner of combination and, furthermore, the influence of the spacial form with all its accompanying conditions is an essentially complicating factor.

4. The structure of composite feelings is, thus, in general exceedingly complicated. Still, there are different degrees of development even here. The complex feelings arising from impressions of touch, smell, and taste are essentially simpler in character than those connected with auditory and visual ideas.

The total feeling connected with outer and inner tactual sensations is designated in particular as the *common feeling*, since it is regarded as the feeling in which our total state of sensible comfort or discomfort expresses itself. From this point of view, the two lowest chemical senses, those of *smell* and *taste*, must also be regarded as contributors to the sensational substratum of the common feeling, for the partial feelings that arise from these two senses unite with those from touch to form unanalyzable affective complexes. In single cases one or the other of these feelings may play the chief part. But, in the midst of all this change in its sensational substratum, the common feeling is always the immediate expression of our sensible comfort and discomfort, and is, therefore, of all our composite feelings most closely related to the simple sense-feelings. Auditory and visual sensations, on the other hand, contribute to the sensational substratum of the common feeling only in exceptional cases, especially when the intensity is unusually great.

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chiefly the affective qualities of which
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5. The common feeling is the source of the distinction between *pleasurable* and *unpleasurable feelings.* This distinction is then carried over to the single simple feelings that compose it, and sometimes even to all feelings. Pleasurable and unpleasurable are expressions well adapted to indicate the chief extremes between which the common feeling, as a total feeling corresponding to the sensible comfort or discomfort of the subject, may oscillate. Though it is to be noted that this feeling may not infrequently lie for a longer or shorter period in an indifference-zone. In the same way, these expressions, pleasurable and unpleasurable, may be applied to the single constituents that go to make up one of the total feelings. On the other hand, it is entirely unjustifiable to apply these names to all other feelings, or, as is sometimes done, to make their applicability a necessary factor in the general definition of feeling. Even for the common feeling, pleasurable and unpleasurable can only be used as general class names which include a number of qualitatively different feelings. The differences among feelings of the same class result from the very great variations in the composition of the single total feelings that we have included under the general name common feeling (cf. p. 92 sq.).

6. This fact that certain common feelings are composite in character explains why it is that there are common feelings which can not, strictly speaking, be called pleasurable or unpleasurable, because they consist in a *succession* of elements belonging to both classes, and under circumstances either the one kind of element or the other may predominate. Such feelings made up of partial feelings of opposite character and deriving their characteristics from this combination, may be called *contrast-feelings.* A simple form of such among the common feelings is that of *tickling.* It is made up of

a weak pleasurable feeling accompanying a weak external tactual sensation, and of feelings connected with muscular sensations which are aroused by the strong reflex impulses from the tactual stimuli. These reflex impulses may spread more or less, and often cause inhibitions of respiration when they reach the diaphragm, so that the resultant feeling may vary greatly in different single cases, in intensity, scope, and composition. Definitions of Psych. fact of common feeli

6 a. The combination of partial feelings into a composite feeling was first noticed in the case of the common feeling. The psychological laws of this combination were indeed misunderstood, and, as is usually the case in physiology, the feeling was not distinguished from its underlying sensations. Common feeling was, thus, sometimes defined as the "consciousness of our sensational state", or again as the "totality, or unanalyzed chaos of sensations" which come to us from all parts of our body. As a matter of fact, the common feeling consists of a number of partial feelings. But it is not the mere sum of these feelings; it is rather a resultant total feeling of unitary character. At the same time it is, however, a total feeling of the simplest possible composition, made up of partial feelings of the first order, that is, of single sense-feelings which generally do not unite to form partial feelings of the second or of higher orders. In the resultant feeling a single partial feeling is usually predominant. This is more especially the case when a very strong local sensation is accompanied by a feeling of pain. On the other hand, weaker sensations may determine the predominant affective tone through their relatively greater importance. This is especially frequent in the case of sensations of smell and taste, and also in the case of certain sensations connected with the regular functioning of the organs, such as the inner tactual sensations accompanying the movements of walking. Often the relatively greater importance of a single sensation is so slight that the predominating feeling can not be discovered except by directing our attention to our own subjective state. In such a case the concentration of the attention upon it can generally make any partial feeling whatever predominant.

References. E. H. Weber, Tastsinn und Gemeingefühl. Wundt, Beiträge zur Theorie der Sinneswahrnehmung, sect. 6, and Grundzüge der phys. Psych. vol. I, chapt. 10, § 3, and Lectures on Hum. and Anim. Psych., lecture 14. On Pathological Changes in the Common Feeling: Störring, Vorlesungen über Psychopathologie (1900), lectures 23 and 24.

7. The composite feelings from sight and hearing are commonly called *elementary aesthetic feelings.* This name includes all feelings that are connected with composite perceptions and are therefore themselves composite. As a special form of feelings belonging to the class defined by the broader meaning of the term αἴσθησις, we have those feelings which are the elements of aesthetic effects in the narrower sense. The term elementary does not apply in this case to the feelings themselves, for they are by no means simple, but it is merely intended to express the relative distinction between these feelings and still more composite, higher aesthetic feelings.

The perceptive, or elementary aesthetic, feelings of sight and hearing may serve as representatives of all the composite feelings that arise in the course of intellectual processes, such as the logical, the moral, and the higher aesthetical feelings, for the general psychological structure of these complex affective forms is exactly like that of the simpler perceptive feelings, except that the former are always connected with feelings and emotions that arise from the whole interconnection of psychical processes.

Agreeable + [illegible]

While the extremes between which the common feelings move are chiefly the affective qualities which we call pleasurable and unpleasurable in the sense of personal comfort and discomfort, the elementary aesthetic feelings belong for the most part to the same affective series, but in the more objective sense of *agreeable* and *disagreeable* feelings. These latter terms express the relation of the object to the ideating subject, rather than any personal state. It is still more apparent here than in the case of pleasurable and unpleasurable feelings, that each of these terms is not the name of a single feeling, but indicates a general group, to which belong an endless variety of feelings with individual peculiarities for each single idea. In single cases, too, but more variably, the other affective series, (p. 92), namely, those of the arousing and subduing feelings, or of the straining and relaxing feelings, may show themselves.

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8. If we neglect for the moment this general classification mentioned, according to which the single cases are brought under the chief affective forms, the perceptive feelings may be divided into the *two* classes of *intensive* and *extensive* feelings, according to the relations which exist between the corresponding sensational elements and determine the quality of the feelings. By *intensive* feelings we mean those that depend on the relation of the qualitative attributes of the sensational elements of ideas, by *extensive* feelings those that arise from the spacial and temporal arrangement of the elements. The expressions "intensive" and "extensive" do not refer to the character of the feelings themselves, for the feelings are in reality always intensive, but the terms refer rather to the *conditions of the rise* of these feelings.

Intensive and extensive feelings are, accordingly, not merely the subjective concomitants of the corresponding ideas but, since every idea consists usually of elements that are qualitatively different and also consists of some extensive arrangement of these elements, the same idea may be at once the substratum of both intensive and extensive feelings. Thus, a visual object made up of different colored parts arouses an intensive feeling through the mutual relation of the colors and it also arouses an extensive feeling through its form. A succession of clangs is connected with an intensive feeling which corresponds to the qualitative relation of the clangs, and also with an extensive feeling coming from the rhythmical or arhythmical temporal succession of these clangs. In this way, both intensive and extensive feelings are always connected with visual and auditory ideas, but, of course, under certain conditions one form may push the other into the background. Thus, when we hear a clang for just an instant, the only feeling perceived is the intensive feeling. Or when, on the other hand, a rhythmical series of indifferent sounds is heard, only the extensive feeling is noticeable. For the purpose of psychological analysis it is obviously of advantage to produce conditions under which one particular affective form is present and others are, so far as possible, excluded.

9. When *intensive feelings* are observed in this way, it appears that those accompanying the *combination of colors* follow the rule that there corresponds to a combination of two colors between which the qualitative difference is a maximum, a maximal agreeable feeling. Still, every particular color combination has its specific character which is made up of the partial feeling from the single colors, and of the total feeling arising as a resultant of the combination. Then, too, as in the case of simple color-feelings, the effect is complicated by chance associations and the complex feelings coming from these associations (p. 86). Combinations of more than two colors have not been adequately investigated.

The feelings connected with *combinations of clangs* are exceedingly numerous and various. They constitute the affective sphere in which we see most clearly the formation discussed above (p. 175), of partial feelings of different orders, together with the interlacings of such feelings which arise under special conditions. The investigations of the single feelings that arise in this way is one of the problems of the psychological aesthetics of music.

10. *Extensive* feelings may be subdivided into spacial and temporal. Of these, the first, or the *feelings of form*, belong mainly to vision, and the second, or the *feelings of rhythm*, belong to hearing, while the beginnings of the development of both forms are to be found in touch.

The *optical feeling of form* shows itself first of all in the preference of regular to irregular forms, and then in the preference among different regular forms of those which have certain *simple* proportions in their various parts. The most important of these proportions are those of symmetry, or $1:1$, and of the golden section, or $x+1:x=x:1$ (the whole is to the greater part as the greater part is to the smaller). The fact that symmetry is generally preferred for the horizontal dimensions of figures and the golden section for the vertical, is probably due to associations, especially with organic forms, such as that of the human body. This preference for regularity and for certain simple proportions can have no interpretation other than that the measurement of every single dimension is connected with an inner tactual sensation from the eye and with an accompanying sense-feeling which enters as a partial feeling into the total optical feeling of form. The total feeling of regular arrangement that arises at the sight of the whole form, is thus modified by the relation of the different sensations to one another, and also by the relation of the partial feelings to one another. As secondary components, which also fuse with the total feeling, there are here also associations and their concomitant feelings.

The *feeling of rhythm* is entirely dependent on the conditions discussed in considering temporal ideas. The partial feelings here are the feelings of strained and fulfilled expectation, which in their regular alternation constitute the rhythmical time ideas themselves. The way in which these partial feelings are united, however, and especially the predominance of special ones in the total feeling, is dependent even more than is the momentary character of an intensive feeling, on the relation in which the feeling present at a given instant stands to the preceding feelings. This is especially apparent in the great influence that every alteration in rhythm exercises on the accompanying feeling. For this reason as well as because of their general dependence on a particular temporal form of occurrence, the feelings of rhythm are direct forms of transition to the *emotions*. To be sure, an emotion may develop from any composite feeling, but in no other case is the condition for the rise of a feeling, as here, at the same time a necessary condition for the rise of a certain degree of emotion. The emotion is, however, usually moderated in this case, through the regular succession of feelings (cf. § 13, 1, 7). Psych Theory of Composite feelings

11. The immense variety of composite feelings and the equally great variety of their conditions, render it impossible to formulate any such comprehensive, and at the same time unitary, psychological theory as that which was possible for spacial and temporal ideas. Still, there are even here some common attributes, through which composite feelings may be brought under certain general psychological heads. There are *two* factors which go to make up every feeling: first, the relation of the combined partial feelings to one another, more p in inten and second, their synthesis into a unitary total feeling. The first of these factors is more prominent in intensive, the second in extensive feelings. In reality both factors are always united, and determine each other reciprocally. Thus, a figure which is all the time agreeable, may be more and more complex the more the relations of its parts accord with

certain rules, and the same holds for a rhythm. On the other hand, the union into a single whole helps to emphasize the separate affective components. In all these respects combinations of feelings show the closest resemblance to intensive ideas. The extensive arrangement of impressions, on the contrary, especially the spacial arrangement, tends much more to favor a relatively independent coexistence of several ideas.

12. The close intensive union of all the components of a feeling, even in the case of those feelings which correspond to spacial or temporal ideas, is connected with a principle that holds for all affective processes, including those which we shall have to discuss later. This principle we can call the *principle of the unity of the affective state.* It may be formulated as follows: in a given moment only *one* total feeling is possible, or in other words, all the partial feelings present at a given moment unite, in every case, to form a single total feeling. This principle is obviously connected with the general relation between idea and feeling. For the "idea" deals with an immediate content of experience and the properties that belong to it, without regard to the subject; the "feeling" expresses the relation that invariably exists between this content and the subject.

Special Theory of Musical

12a. Of all the different forms of elementary aesthetic feelings mentioned, the feelings of tonal *harmony* and *discord* are the most suitable for the purposes of psychological analysis, because of the relatively obvious character of their sensation basis. Furthermore, the interest in the study of the aesthetics of music has existed for a long time and has served to bring out a great variety of theoretical explanations of these feelings. To be sure, these explanations have not infrequently paid too little attention to the actually observable facts. They have often substituted hypothetical and purely arbitrary assumptions for observation. Such is the case when harmony is explained as an unconscious recognition of regular number relations (Euler); or when harmony is attributed to an unconscious effect of the rhythm of sound vibrations (Lipps); or finally, when harmony is attributed to the effects of tonal fusion (Stumpf). Sometimes, on the other hand, a single contributing factor is given undue prominence, as when the disturbing effect of beats is the only recognized factor in dissonance (Helmholtz). On the basis of the facts pointed out in §§ 6 and 9 we may recognize the following *three* conditions as those which probably have the greatest significance for the feeling of harmony. The first condition consists in the fact that there is a preference for simple divisions of the tonal line, in keeping with the principle of arithmetical division which holds for our tonal sensations. This is illustrated in the case of the major cord where the ratios are 4 : 5 : 6 (p. 58 sq., metrical principle). This preference explains the agreeableness of harmonious intervals when tones which are entirely without overtones are sounded, either simultaneously or in succession. The second condition consists in the coincidence of the partial tones of the clang, which coincidence increases in degree as the harmony increases. This phonic principle, as we may call it, shows itself in the relation between tones when the tones are successive, and when the tones are simultaneous it shows itself in the intensification of certain partial tones (difference-tones or over-tones) which are characteristic of the given intervals in any particular case. The third condition consists in the fact that beats of the primary tones, or beats of the over-tones and difference-tones, appear in the case of dissonant intervals in compound clangs. (Principle of dissonant beats).

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§ 13. EMOTIONS.

Definition

1. Feelings, like all psychical phenomena, are never permanent states. In the psychological analysis of a composite feeling, therefore, we must always think of a momentary affective state as if it were held constant. This can be done the more easily the more slowly and continuously the psychical processes occur, so that the word *feeling* has come to be used mainly for relatively slow processes and for those which in their regular form of occurrence never pass beyond a certain medium intensity, such as the feelings of rhythm. Where, on the other hand, a series of feelings succeeding one another in time unite into an interconnected process which is distinguished from preceding and following processes as an individual whole, and which has in general a more intense effect on the subject than a single feeling, we call such a succession of feelings an *emotion*.

This very name indicates that it is not any specific subjective contents of experience which distinguish emotion from feeling, but rather the arousing effect which comes from a special combination of particular affective contents. In this way it comes that there is no sharp line of demarcation between feeling and emotion. Every feeling of greater intensity passes into an emotion. The separation of the feelings within an emotion from one another is always a more or less arbitrary sundering of complete relations. In the case of feelings which have a certain particular form of occurrence, that is in feelings of *rhythm*, such a breaking up of the emotions is entirely impossible. The feeling of rhythm is distinguished from an emotion only by the small intensity of its moving effect on the subject, which is what gives "emotion" its name. And even this distinction is by no means fixed, for when the feelings produced by rhythmical impressions become somewhat more intense, as is usually the case, especially when the rhythm is connected with sensational contents that arouse the feelings greatly, the feelings of rhythm become in fact emotions. Rhythms are for this reason the important means both in music and poetry of portraying emotions and arousing them in the auditor. James

2. The names of different emotions, like those of feelings, do not indicate single processes, but classes in which a large number of single affective processes are grouped because of certain common characteristics. Emotions such as joy, hope, anxiety, care, and anger, are accompanied in every case by new ideational contents; their affective elements also, and even the way in which the emotions themselves occur, may vary greatly. The more composite a psychical process, the more variable will be its single concrete manifestations; a particular emotion will, therefore, be less apt to occur in exactly the same form than will a particular feeling. Every general name for emotions indicates, accordingly, certain *typical forms in which related affective processes occur.*

3. Not every interconnected series of affective processes is called an emotion or is to be classed as such under one of the typical forms discriminated by language. An emotion is a unitary whole which is distinguished from a composite feeling through two characteristics. First, an emotion has a definite temporal course and secondly, it exercises a more intense present and subsequent effect on the interconnection of psychical processes. The first characteristic arises from the fact that an emotion is a process of a higher order as compared with a single feeling, for it always includes a

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succession of several feelings. The second characteristic depends on the intensification of the effect produced by the summation of the feelings.

As a result of these characteristics, emotions have in the midst of all their variations in form a regularity in the manner of their occurrence. They always begin with a more or less intense *inceptive feeling* which in its quality and direction is immediately characteristic of the nature of the emotions. This inceptive feeling is due either to an idea produced by an external impression (outer emotional stimulation) or to a psychical process arising from associative or apperceptive conditions (inner stimulation). Following this inceptive feeling, comes an *ideational process* accompanied by its corresponding feelings. This process shows in cases of particular emotions, characteristic differences both in the quality of its feelings and in its rapidity. Finally, the emotion closes with a *terminal feeling* which continues even after the emotion has given place to a quiet affective state. In this terminal feeling the emotion gradually fades away, unless it passes directly into the inceptive feeling of a new emotion. This last mentioned transition sometimes occurs, especially in feelings of the intermittent type (inf. 13).

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movements

4. The intensification of the effect which may be observed in the course of an emotion, appears not merely in the psychical contents of the feelings that compose it, but in the *physical* concomitants as well. For single feelings these accompanying phenomena are usually limited to slight changes in the innervation of the heart and respiratory organs, which can be demonstrated only by using exact graphic methods (p. 96 sq.). It is only in relatively rare cases that there are added to these minor forms of reaction, mimetic movements of even moderate extent and intensity. With emotions the case is essentially different. As a result of the summa-

tion and alternation of successive affective stimuli there is in emotions not only an intensification of the effect on heart, blood-vessels, and respiration, but the *external muscles* are always affected in an unmistakable manner. Strong movements of the mimetic muscles appear at first, then movements of the arms and of the whole body (pantomimetic movements). In the case of stronger emotions there may be still more extensive disturbances of innervation, such as trembling, convulsive contractions of the diaphragm and of the facial muscles, and paralytic relaxation of the muscles.

Because of their symptomatical significance for the emotions, all these movements are called *expressive movements.* As a rule they are entirely involuntary, being either reflexes following emotional excitations, or else impulsive acts prompted by the affective components of the emotion. They may be modified, however, in the most various ways through voluntary intensification or inhibition of the movements or even through intentional production of the same, so that the whole series of external reactions which we shall have to discuss under volitional acts, may enter into these expressive movements (§ 14).

Classif. of Exp. Movements.

5. According to their symptomatical character, expressive movements may be divided into *three* classes. 1) *Purely intensive* symptoms; these are always expressive movements for more intense emotions, and consist of strong movements for emotions of middle intensity, and of sudden inhibitions and paralysis of movement for violent emotions. 2) *Qualitative expressions of feelings*; these are *mimetic* movements, the most important of which are the reactions of the oral muscles, resembling the reflexes following sweet, sour, and bitter impressions of taste. The reaction for sweet corresponds to pleasurable emotions, the reactions for sour and bitter, to unpleasurable emotions, while the other modifications of

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3) Expression of Ideas by gestures

feeling, such as excitement and depression, strain and relief, are expressed by a tension of the muscles. 3) *Expressions of ideas*; these are generally *pantomimetic* movements that either point to the object of the emotion (indicative gestures) or else describe the objects as well as the processes connected with them by the form of the movement (representative gestures). These three classes of expressive movements correspond exactly to the psychical elements of emotions: the first class corresponds to the intensity of the psychical elements, the second to the quality of the feelings, and the third to the ideational content. A concrete expressive movement may unite all three forms in itself. The third class, that of expressions of ideas, is of special psychological significance because of its genetic relations to *speech* (cf. § 21, 3).

6. The changes in *pulse* and *respiration* that accompany emotions are of three kinds. 1) They may consist of the immediate effects of the feelings which make up the emotions, as, for example, a lengthening of the pulse curve and respiration curve when the feelings are pleasurable, and a shortening of the same for unpleasurable feelings (cf. sup. p. 96). This holds only for *relatively quiet* emotions, where the single feelings have sufficient time to develop. When sufficient time is not given, other phenomena appear which depend, not merely on the quality of the feelings, but also, and that mainly, on the intensity of the innervations, due to the summation of these innervations. 2) Such summations may consist of *intensified* innervation. This arises from an *increase* in the excitation which in turn results from an adding together of the separate effects when the succession of feelings is not too rapid. This increase shows itself in retarded and strengthened pulse-beats, since the more intense excitation affects most the inhibitory nerves of the heart. Besides these there

is usually an increased innervation of the mimetic and pantomimetic muscles. These are called *sthenic emotions.* 3) If the feelings are very violent or last an unusually long time in a single direction, the emotion brings about a more or less complete *paralysis* of the innervation of the heart and a reduction of the tension of the outer muscles. Under certain circumstances disturbances in the innervation of special groups of muscles appear, especially in the innervation of the muscles of the diaphragm and the innervation of the sympathetic facial muscles. The first symptom of the paralysis of the regulative cardiac nerves is a marked acceleration of the pulse and a corresponding acceleration of the respiration, accompanied by a weakening of the same, and a relaxation of the tension of the external muscles to a degree equal to that in paralysis. These are the *asthenic emotions.* There is still another distinction, which is not important enough, however, to lead to the formation of an independant class of physical effects of emotions, since we have to do here only with modifications of the phenomena characteristic of sthenic and asthenic emotions. It is the distinction between *rapid* and *sluggish* emotions, based upon the greater or less *rapidity* with which the increase or inhibition of the innervation appears. Induction of emotions thro' Phy [illegible]

7. Both in natural and in voluntarily aroused emotions the physical concomitants have, besides their symptomatical significance, the important psychological attribute of being able to *intensify the emotion.* This attribute is due to the fact that the excitation or inhibition of certain particular groups of muscles is accompanied by inner tactual sensations which produce certain *sense-feelings.* These feelings unite with the other affective contents of the emotion and increase the intensity of the emotion. From the heart, respiratory organs, and blood-vessels we have such feelings only in cases of

emotions, when the feelings may indeed be very intense. On the other hand, even in moderate emotions the state of greater or less tension of the mimetic and pantomimetic muscles, exercises an influence on the affective state and thereby on the emotion.

History of Theory of Emotions; Pa

7 a. Older psychology, because of its general tendency to give an intellectualistic interpretation to psychical processes, generally offered logical reflections about emotions, as a theory of the emotions, or even as a full description of them. The best illustration of this kind of a theory of the emotions is the doctrine of **Spinoza**. In such theories the psychological treatment was very largely influenced by *ethical* considerations. As one result of such influence, we have the distinction between emotions and *passions*, the latter term being employed to designate those conditions in which certain particular impulses through long continued feeling and emotions, gain the complete ascendency over volition. **Kant** modified these definitions of emotions and passions, in that he regarded the essential attribute of emotions to be their sudden rise, while the essential attribute of passions consisted for him in the fact that the tendencies of feeling have settled into fixed habits. These modes of classification are all either of merely practical significance and belong accordingly in the domain of characterology or ethics, or else they are based upon characteristics which are essential only in discussions of the intensity and course of emotions, and will, accordingly, be dealt with under these heads in a later paragraph (12). From the psychological point of view, the passions are in no essential respect different in nature from the emotions. In contrast with this practical mode of treating the emotions, there has arisen a tendency in recent times to give more and more attention to the expressive movements, and to the other physiological accompaniments of the emotions which show themselves in the pulse and respiration and in the vaso-motor changes. There begins to show itself thus, a recognition of the value of these phenomena as aids to the study of the emotions, just as there is a recognition of the innervation symptoms of feelings. To be sure, the study of these outer phenomena can never take

the place of immediate observation of the psychical processes themselves; it can serve at most to call attention to certain of the attributes and relations of the psychical processes which might perhaps be otherwise overlooked. Thus, for example, the objective observation suggests very easily the fact that emotions are intensified through the sensory feelings which are connected with the expressive movements. But when LANGE and JAMES make these concomitant phenomena the exclusive *causes* of the emotions, when they describe the emotions as psychical processes which can be aroused only through expressive movements, we must reject their paradoxical view for the following three reasons. First, the definite outer symptoms of emotions do not appear until such time as the psychical nature of the emotion is already clearly established. The emotion, accordingly, precedes the innervation effects which are looked upon by these investigators as causes of the emotion. Secondly, it is absolutely impossible to classify the rich variety of psychical emotional states in the comparatively simple scheme of innervation changes. The psychical processes are much more varied than are their accompanying forms of expression. Thirdly, and finally, the physical concomitants stand in no *constant* relation to the *psychical quality* of the emotions. This holds especially for the effects on pulse and respiration, but is true also for the pantomimetic expressive movements. It may sometimes happen that emotions with very different, even opposite kinds of affective contents, may belong to the same class so far as the accompanying physical phenomena are concerned. Thus, for example, joy and anger may be in like manner sthenic emotions. Joy accompanied by surprise may, on the contrary, present the appearance, on its physical side of an asthenic emotion.

(Relation of the changes [illegible] [illegible] to the form[illegible] attributes [illegible] the Emot[illegible]

7b. The general phenomena of innervation which give rise to the distinction between sthenic and asthenic, and rapid and sluggish emotions, do not show the character of the affective contents of these emotions, but only the *formal* attributes of the intensity and rapidity of the feelings. This is clearly proved by the fact that differences in involuntary innervation analogous to those which accompany the different emotions, may be produced by a mere succession of indifferent impressions, as, for example, by the strokes of a metronome. It is observed in such a case that especially the *respiration* tends to adapt itself to the faster or slower rate of the strokes, becoming more rapid when the rapidity of the metronome increases. Commonly, too, certain phases of respiration coincide with particular strokes. Furthermore, the hearing of such an indifferent rhythm is not unattended by emotion. When the rate changes, we observe at first a quiet, then a sthenic, and finally, when the rapidity is greatest, an asthenic emotion. Still, the emotions in this case have to a certain extent a mere formal character; they exhibit a great indefiniteness in their contents. This indefiniteness disappears only when we think into them concrete emotions of like formal attributes. This is very easy, and is the condition of the great utility of rhythmical impressions for describing and producing emotions. All that is necessary to arouse an emotion in all its fulness, is a mere hint of qualitative affective content, such as it is possible to give in music through the clangs of a musical composition.

7c. The external expressive effects of emotions are, accordingly, ambiguous symptoms and can, therefore, have, when taken by themselves, no psychological value. They may, however, acquire such value when connected with introspection which has been properly provided for in an experimental way. Indeed, as checks for experimental introspection the expressive movements have great value. The principle that observation is wholly inadequate when applied to psychical processes which present themselves in the natural course of life, holds especially for the emotions. In the first place, emotions come to the psychologist by chance, at moments when he is not in a condition to subject them to scientific analysis; and secondly, in the case of strong emotions the causes of which are real, we are least of all able to observe ourselves with exactness. Exact observation can be carried on much more successfully when we *voluntarily* arouse in ourselves a particular emotional state. In such a case, however, it is not possible to estimate how nearly the subjectively aroused emotion agrees in intensity and in mode of occurrence with one of like character due to external circumstances. For this reason the simultaneous investigation of the physical effects, especially of those effects most removed from the influence of the will, namely, the effects on the pulse and respiration, furnishes a check for introspection. For when the psychological quality of emotions is alike, we may infer from their like physical effects that their formal attributes also agree. Indeed, the intensity of the expressive movement furnishes a fairly reliable measure of the degree in which the artificial emotion approximates the natural emotion.

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Psy. classification of the Emotions

8. The great number of factors that must be taken into consideration for the investigation of emotions renders a psychological analysis of the single forms impossible. This is all the more so because each of the numerous distinguishing names marks off a whole *class*, within which there is a great variety of special forms, including in turn an endless number of single cases of the most various modifications. All we can do is to take a general survey of the *fundamental forms of emotions*. The general principles of division here employed must be *psychological*, that is, such as are derived from the immediate attributes of the emotions themselves, for the accompanying *physical* phenomena have only a symptomatical value and are even then, as noted above, frequently equivocal in character.

Three such psychological principles of classification may be made the basis for the discrimination of emotions: 1) emotions may be grouped according to the *quality* of the feelings entering into the emotions, 2) according to the *intensity* of these feelings, 3) according to the *form of occurrence*, this form being conditioned by the character and rate of the affective changes.

Emotional Forms) Affec. Quality.

9. On the basis of *quality* of feelings we may distinguish certain fundamental emotional forms corresponding to the chief affective dimensions distinguished above (p. 92). This gives us pleasurable and unpleasurable emotions, exciting and depressing emotions, straining and relaxing emotions. It must be noted, however, that because of their more composite character the emotions are always, even more than the feelings, *mixed* forms. Generally only a *single* affective tendency can be called *primary* for a particular emotion. There are affective elements belonging to other dimensions which enter in as secondary elements. The secondary character of such elements usually appears in the fact that under different conditions various sub-forms of the primary emotion may arise. Thus, for example, joy is primarily a pleasurable emotion. Ordinarily it is also exciting, since it intensifies the feelings, but when the feelings are too strong, it becomes a depressing emotion. Sorrow is an unpleasurable emotion, generally of a depressing character; when the intensity of the feelings becomes somewhat greater, however, it may become exciting, and when the intensity becomes maximal, it passes again into depression. Anger is much more emphatically exciting and unpleasant in its predominant characteristics, but when the intensity of the feelings becomes greater, as when it develops into rage, it becomes depressing. Thus, exciting and depressing tendencies are always mere secondary qualities connected with pleasurable and unpleasurable emotions. Feelings of strain and relaxation, on the contrary, may more frequently be the primary components of emotions. Thus, in expectation, the feeling of strain peculiar to this state is the primary element of the emotion. When the feeling develops into an emotion, it may easily be associated with unpleasurable feelings which are, according to circumstances, either exciting or depressing.

In the case of rhythmical impressions or movements there arise from the alternation of feelings of strain with those of relaxation, pleasurable emotions which may be at the same time either exciting or depressing, according to the character of the rhythm. When they are depressing there may be unpleasurable feelings intermingled with them, or the feelings may all become unpleasurable, especially when other affective elements cooperate, as for example in feelings of clang or harmony.

10. Language has paid the most attention in its development of names for emotions to the *qualitative* side of feelings, and among these qualities particularly to pleasurable and unpleasurable forms. These names may be divided into *three* classes. First we have names of emotions that are *subjectively* distinguished, chiefly through the nature of the affective state itself. Such are joy and sorrow and, as subforms of sorrow in which either depressing, straining, or relaxing tendencies of the feeling are also exhibited, sadness, care, grief, and fright. Secondly, there are names of *objective* emotions referring to some external object, such as delight and displeasure and, as subforms of the latter in which, various tendencies unite, annoyance, resentment, anger, and rage. Thirdly, we have names of *objective* emotions that refer rather to outer events not expected until the *future*, such as hope and fear and, as modifications of the latter, worry and anxiety. They are combinations of feelings of strain with pleasurable and unpleasurable feelings and, in different ways, with exciting and depressing tendencies as well.

Obviously language has produced a much greater variety of names for unpleasurable emotions than for pleasurable. This may be due either to an actual superiority in the number of unpleasurable forms of emotion, or it may be due to the fact that unpleasurable experiences attract a higher degree of attention. Probably the full explanation involves both factors. Emot. Forms [illegible] Intensity

11. On the basis of the *intensity* of the feelings, two classes of emotions, namely, the *weak* and the *strong* may be distinguished. These concepts, derived from the psychical properties of the feelings, do not coincide with the concepts of sthenic and asthenic emotions, based upon the physical concomitants, for the relation of the psychological categories to the psycho-physical, is dependent not only on the intensity of the feelings, but on their quality as well. Thus, weak and moderately strong pleasurable emotions are always sthenic, while, on the contrary, unpleasurable emotions become asthenic after a longer duration, even when they are of a low degree of intensity, as, for example, care and anxiety. Finally, the strongest emotions, such as fright, worry, rage, and even excessive joy, are always asthenic. The discrimination of the psychical intensity of emotions is accordingly of subordinate significance, especially since emotions that agree in all other respects, may not only have different degrees of intensity at different times, but may on the same occasion vary from moment to moment. Then too, since this variation from moment to moment is essentially determined by the sense-feelings that arise from the accompanying physical phenomena, in accordance with the principle of the intensification of emotions discussed above (p. 191), it is obvious that sthenic and asthenic character which is due originally to certain physiological conditions, often has a more decisive influence even on the psychological character of the emotion than the primary psychical intensity itself.

12. The third distinguishing characteristic of emotions, the *form of occurrence*, is more important. Here we distinguish three classes. First, there are *sudden*, *irruptive* emotions, such as surprise, astonishment, fright, disappointment, and rage.

They all reach their maximum very rapidly and then gradually sink to a quiet affective state. Secondly, we have *gradually arising* emotions, such as anxiety, doubt, care, mournfulness, expectation, and in many cases joy, anger, worry. These rise to their maximum gradually and sink in the same way. As a third form, and at the same time a modification of the class just mentioned, we have *intermittent* emotions, in which several periods of rise and fall follow one another alternately. All emotions of long duration belong in this last class. Thus, especially joy, anger, mournfulness, and the most various forms of gradually arising emotions, come in waves and often permit a distinction between periods of increasing and those of decreasing emotional intensity. The sudden, irruptive emotions, on the contrary, are seldom intermittent. They are intermittent only in cases in which the emotion may belong also to the second class. Such emotions of a very changeable form of occurrence are, for example, joy and anger. They may sometimes be sudden and irruptive. In such cases, to be sure, anger generally becomes rage. Or such emotions may gradually rise and fall; they are then generally of the intermittent type. In their psycho-physical concomitants, the sudden irruptive emotions are all asthenic, the gradually arising emotions may by either sthenic or asthenic.

Determinative significance of affective Qualities discrim of Emoti

12a. The form of occurrence, then, however characteristic it may be in single cases, is just as little a fixed criterion for the psychological classification of emotions as is the intensity of the feelings. Obviously a psychological classification can be based only on the *quality* of the affective contents, while intensity and form of occurrence may furnish the means of subdivision. The way in which these conditions are connected with one another and with the accompanying physical phenomena and through these with secondary sense-feelings, shows the emotions to be most highly composite psychical compounds which are therefore in single cases exceedingly variable. A classification which is in any degree exhaustive must, therefore, subdivide such varying emotions as joy, anger, fear, and anxiety into their subforms, according to their modes of occurrence, according to the intensity of their component feelings, and finally according to their physical concomitants, which physical concomitants are dependent on both the psychical factors mentioned. Thus, for example, we may distinguish a strong, a weak, and a variable form of anger, a sudden, a gradually arising, and an intermittent form of its occurrence, and finally a sthenic, asthenic, and a mixed form of its expressive movements. For the psychological explanation, an account of the causal interconnection of the single forms in each particular case is much more important than this mere classification. In giving such an account, we have to deal in the case of every emotion with *two* factors: first the *quality* and *intensity* of the component feelings, and second, the *rapidity of the succession* of these feelings. The first factor determines the general character of the emotion, the second its intensity in part, and more especially its form of occurrence, while both together determine its physical accompaniments and the psycho-physical changes resulting from the sense-feelings connected with these accompanying phenomena (p. 189). It is for this very reason that the physical concomitants are as a rule to be called *psycho-physical*. The expressions "psychical" and "psycho-physical" should not, however, be regarded as absolute opposites in such a case as this where we have to do merely with symptoms of emotion. We speak of psychical emotional phenomena when we mean those that do not show any immediately perceptible physical symptoms, even when such symptoms can be demonstrated with exact apparatus (as, for example, changes in the pulse and in respiration). On the other hand we speak of psycho-physical phenomena in those cases which can be immediately recognized as two-sided.

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§ 14. VOLITIONAL PROCESSES.

Relation to Emoti

1. Every emotion, made up, as it is, of a unified series of interrelated affective processes, may terminate in one of two ways. It may give place to the ordinary variable and relatively unemotional course of feelings. Such affective processes that fade out without any special result, constitute the *emotions in the strict sense*, such as were discussed in the last paragraph. In a second class of cases the emotional process may pass into a *sudden* change in ideational and affective content, which brings the emotion to an instantaneous close; such changes in the sensational and affective state which are prepared for by an emotion and bring about its sudden end, are called *volitional acts*. The emotion together with its result is a *volitional process*.

A volitional process is thus related to an emotion as a process of a higher stage, in the same way that an emotion is related to a feeling. Volitional act is the name of only one part of the process, that part which distinguishes a volition from an emotion. The way for the development of volitions out of emotions is prepared by those emotions in connection with which external pantomimetic expressive movements (p. 189) appear. These expressive movements appear chiefly at the end of the process and generally hasten its completion; this is especially true of anger, but to some extent also of joy, care, etc. Still, in these mere emotions there is an entire absence of those changes in the train of ideas, which changes are the immediate causes of the momentary transformation of the emotion into volitions, and are also accompanied by characteristic feelings.

This close interconnection of volitional acts with pantomimetic expressive movements necessarily leads us to consider as the earliest stages of volitional development those volitions which end in certain bodily movements, which are in turn due to the preceding train of ideas and feelings. In other words, we come to look upon volition ending in *external* volitional acts, as the earliest stages in the development of volitions. The so-called *internal* volitional acts, on the other hand, or those which close simply with effects on ideas and feelings, appear in every case to be products of later development.

External Volit. Acts

2. A volitional process that passes into an *external* act may be defined as an emotion which closes with a pantomimetic movement which has, in addition to the characteristics belonging to all such movements and due to the quality and intensity of the emotion, the special property of *producing an external effect which removes the emotions itself*. Such an effect is not possible for all emotions, but only for those in which the very succession of component feelings produces feelings and ideas which are able to remove the preceding emotion. This is, of course, most commonly the case when the final result of the emotion is the direct opposite of the preceding feelings. The fundamental psychological condition for volitional acts is, therefore, the *contrast between feelings*, and the origin of the first volitions is most probably in all cases to be traced back to unpleasurable feelings which arouse external movements, which in turn produce contrasted pleasurable feelings. The seizing of food to remove hunger, the struggle against enemies to appease the feeling of revenge, and other similar processes are original volitional processes of this kind. The emotions coming from sense-feelings, and the most widespread social emotions such as love, hate, anger, and revenge, are thus, both in men

and animals, the common origin of will. A volition is distinguished in such cases from an emotion only by the fact that the former has added to its emotional components an external act that gives rise to feelings which, through contrast with the feelings contained in the emotion, bring the emotion itself to an end. The execution of the volitional act may then lead directly, as was originally always the case, or indirectly through an emotion of contrasted affective content, into the ordinary quiet flow of feelings. Relat to feeli

3. The richer the ideational and affective contents of experience, the greater the variety of the emotions and the wider the sphere of volitions. There is no feeling or emotion that does not in some way prepare for a volitional act, or at least have some part in such a preparation. All feelings, even those of a relatively indifferent character, contain in some degree an effort towards or away from some end. This effort may be very general and aimed merely at the maintenance or removal of the present affective state. While volition appears as the most complex form of affective process, presupposing feelings and emotions as its components, still, we must not overlook, on the other hand, the fact that single feelings continually appear which do not unite to form emotions, and emotions appear which do not end in volitional acts. In the total interconnection of psychical processes, however, these three stages are conditions of one another and form the related parts of a single process which is complete only when it becomes a volition. In this sense a feeling may be thought of as the beginning of a volition, or a volition may be thought of as a composite affective process, and an emotion may be regarded as an intermediate stage between the two.

Motives of Volition

4. The single feelings in an emotion which closes with a volitional act are usually far from being of equal impor-

tance. Certain ones among them, together with their related ideas, are prominent as those which are *most important* in preparing for the act. Those combinations of ideas and feelings which in our subjective consciousness are the immediate antecedents of the act, are called *motives* of volition. Every motive may be divided into an ideational and an affective component. The first we may call the *moving reason*, the second the *impelling feeling* of action. When a beast of prey seizes his victim, the moving reason is the sight of the victim, the impelling feeling may be either the unpleasurable feeling of hunger or the race-hate aroused by the sight. The reason for a criminal murder may be theft, removal of an enemy, or some such idea, the impelling feeling the feeling of want, hate, revenge, or envy.

When the emotions are of composite character, the reasons and impelling feelings are mixed, often to so great an extent that it would be difficult for the author of the act himself to decide which was the leading motive. This is due to the fact that the impelling feelings of a volitional act combine, just as the elements of a composite feeling do, to form a *unitary* whole in which all other impulses are subordinated to a single predominating one; the feelings of like direction strengthening and accelerating the effect, those of opposite direction weakening it. In the combinations of ideas and feelings which we call motives, the final weight of importance in preparing for the act of will belongs to the feelings, that is, to the impelling feelings rather than to the ideas. This follows from the very fact that feelings are integral components of the volitional process itself, while the ideas are of influence only indirectly, through their connections with the feelings. The assumption that a volition may arise from pure intellectual considerations, or that a decision may appear which is opposed to the inclinations expressed in the feelings, is a psychological contradiction in itself. It rests upon the abstract concept of a will which is transcendental and absolutely distinct from actual psychical volitions.

The combination of a number of motives, that is, the combination of a number of ideas and feelings which stand out from the composite train of emotions to which they belong as the ideas and feelings which determine the final discharge of the act — this combination furnished the essential condition for the *development of will*, and also for the discrimination of the *single forms of volitional action.* Devel. of Voliti

5. The simplest case of volition is that in which a single feeling in an emotion of suitable constitution, together with its accompanying idea, becomes a motive and brings the process to a close through an appropriate external movement. Such volitional processes determined by a *single* motive, may be called *simple volitions.* The movements in which they terminate are often designated *impulsive acts.* In popular parlance, however, this definition of impulse by the simplicity of the motive, is not sufficiently adhered to. Another element, namely, the character of the feeling that acts as impelling force is, in popular thought, usually brought into the definition. All acts that are determined by *sense-feelings*, especially common feelings, are generally called impulsive acts without regard to whether a single motive or a plurality of motives is operative. This basis of discrimination is psychologically inappropriate and there is no justification for the complete separation to which it naturally leads between impulsive acts and volitional acts as specifically distinct kinds of psychical processes.

By impulsive act, then, we mean a *simple* volitional act, that is, one resulting from a single motive, without reference to the relative position of this motive in the series of affective and ideational processes. Impulsive action, thus defined, must necessarily be the starting point for the development of all volitional acts, even though it may continue to appear later, along with the complex volitional processes. To be sure, the earliest impulsive acts are those which come from sense-feeling. Thus, most of the acts of animals are impulsive, but such impulsive acts appear continually in the case of man, partly as the results of simple sense emotions, partly as the products of the habitual execution of certain volitional acts which were originally determined by complex motives (10).

Voluntary & Selective Acts

6. When several feelings and ideas in the same emotion tend to produce external action, and when those components of an emotional train which have become motives tend at the same time toward different external ends, whether related or antagonistic, then there arises out of the simple act a *complex volitional process*. In order to distinguish this from a simple volitional act, or impulsive act, we call it a *voluntary act.*

Voluntary and impulsive acts have in common the characteristic of proceeding from *single* motives, or from complexes of motives that have fused together and operate as a single *unequivocal* impulse. They differ in the fact that in voluntary acts the decisive motive has risen to predominance from among a number of simultaneous and antagonistic motives. When a clearly perceptible strife between these antagonistic motives precedes the act, we call the volition by the particular name *selective act*, and the process preceding it we call a *choice.* The predominance of one motive over other simultaneous motives can be understood only when we presuppose such a strife in every case. But we perceive this strife now clearly, now obscurely, and now not at all. Only in the first case can we speak of a selective act in the proper sense. The distinction between ordinary voluntary acts and selective acts is by no means hard and fast. In ordinary voluntary acts the psychical state is, however, more like that in impulsive acts, and the difference between such impulsive acts and selective acts is clearly recognizable.

7. The psychical process immediately preceding the act, in which process the final motive suddenly gains the ascendency, is called in the case of voluntary acts *resolution*, in the case of selective acts *decision*. The first word indicates merely that action is to be carried out in accordance with some consciously adopted motive; the second implies that several courses of action have been presented as possible and that a choice has finally been made. Feeling of activit

In contrast to the *first stages* of a volition, which can not be clearly distinguished from an ordinary emotional process, the *last stages* of volition are absolutely characteristic. They are especially marked by accompanying *feelings* that never appear anywhere but in volitions, and must therefore be regarded as the specific elements peculiar to volition. These feelings are first of all *feelings of resolution and feelings of decision*. Feelings of decision differ from feelings of resolution only in the fact that the former are more intense. They are both exciting and relaxing feelings, and may be united under various circumstances with pleasurable or unpleasurable factors. The relatively greater intensity of the feeling of decision is probably due to its contrast with the preceding feeling of *doubt* which attends the wavering between different motives. The opposition between doubt and decision gives the feeling of relaxation a greater intensity. At the moment when the volitional act begins, the feelings of resolution give place to the specific *feeling* of *activity*, which has its sensational substratum, in the case of external volitional acts, in the sensations of tension accompanying the movement. This feeling of activity is clearly exciting in its character, and may, according to the special motives of the volition, be accompanied now by pleasurable, now by unpleasurable elements, which may in turn vary in the course of the act and alternate with one another. As a total feeling, this feeling of activity is a rising and falling temporal process extending through the whole act and finally passing into the most various feelings, such as those of fulfilment, satisfaction, or disappointment, or into the feelings and emotions connected with the special result of the act. Taking the process as seen in voluntary and selective acts as *complete* volitional acts, the essential reason for distinguishing *impulsive* acts from complete volitional acts is to be found in the absence of the antecedent feelings of resolution and decision. The feeling connected with the motive passes in the case of impulsive acts directly into the feeling of activity, and then into the feelings which correspond to the effect of the act. Weakening of Emot. thru Intell. Process

8. The transition from simple to complex volitional acts brings with it a number of other changes which are of great importance for the development of will. The first of these changes is to be found in the fact that the *emotions* which introduce volitions lose their intensity more and more, as a result of the counteraction of different mutually inhibiting feelings, so that finally a volitional act may result from an apparently unemotional affective state. To be sure, emotion is never entirely wanting; in order that the motive which arises in an ordinary train of feelings may bring about a resolution or decision, it must always be connected with some degree of emotional excitement. The emotional excitement can, however, be so weak and transient that we overlook it. We do this the more easily the more we are inclined to unite in the *single* idea of the volition both the short emotion which merely attends the rise and action of

the motive, and the resolution and execution which constitute the act itself. This weakening of the emotions results mainly from the combinations of psychical processes which we call *intellectual* development and of which we shall treat more fully in the discussion of the interconnection of psychical compounds (§ 17). Intellectual processes can, indeed, never do away with emotions; such processes are, on the contrary, in many cases the sources of new and characteristic emotions. A volition entirely without emotion, determined by a purely intellectual motive, is, as already remarked (p. 204), a psychological impossibility. Still, intellectual development exercises beyond a doubt a moderating influence on emotions. This is particularly true whenever intellectual motives enter into the emotions which prepare the way for volitional acts. This may be due partly to the counteraction of the feelings which generally takes place, or it may be due partly to the slow development of intellectual motives, for emotions usually are the stronger, the more rapidly their component feelings rise. Devel. of Internal Volit. Acts

9. Connected with this moderation of the emotional components of volitions under the influence of intellectual motives, is still another change. It consists in the fact that the *act* which closes the volition is not an external movement. The effect which removes the exciting emotion is itself a psychical process which does not show itself directly through any external symptom whatever. Such an effect which is imperceptible for objective observation is called an *internal volitional act*. The transition from external to internal volitional acts is so bound up with intellectual development that the very character of the intellectual processes themselves is to be explained to a great extent by the influence of volitions on the train of ideas (§ 15, 9). The act that closes the volition in such a case is some change in the train of ideas,

which change follows the preceding motives as the result of some resolution or decision. The feelings that accompany these acts of immediate preparation, and the feeling of activity connected with the change itself, agree entirely with the feelings observed in the case of external volitional acts. Furthermore, action is followed by more or less marked feelings of satisfaction, of removal of preceding emotional and affective strain. The only difference, accordingly, between these special volitions connected with the intellectual development and the earlier forms of volition, is to be found in the fact that here the final effect of the volition does not show itself in an external bodily movement.

Still, we may have a bodily movement as the *secondary* result of an internal volitional act, when the resolution refers to an external act to be executed at some later time. In such a case the act itself always results from a second, later volition. The decisive motives for this second process come, to be sure, from the preceding internal volition, but the two are nevertheless distinct and different processes. Thus, for example, the formation of a resolution to execute an act in the future under certain expected conditions, is an internal volition, while the later performance of the act is an external action different from the first, even though requiring the first as a necessary antecedent. It is evident that where an external volitional act arises from a decision after a conflict among the motives, we have a transitional form in which it is impossible to distinguish clearly between the two kinds of volition, namely, that which consists in a single unitary process and that which is made up of *two* processes, that is, of an earlier and a later volition. In such a transitional form, if the decision is at all separated in time from the act itself, the decision may be regarded as an internal volitional act preparatory to the execution.

Retrogradation

10. These two changes which take place during the development of will, namely, the moderation of emotions and the rendering independent of internal volitions, are changes of a progressive order. In contrast with these there is a *third* process which is one of *retrogradation*. When complex volitions with the same motive are often repeated, the conflict between the motives grows less intense; the opposing motives that were overcome in earlier cases grow weaker and finally disappear entirely. The complex act has then passed into a simple, or *impulsive act*. This retrogradation of complex volitional processes shows clearly the utter inappropriateness of the limitation of the concept "impulsive" to acts of will arising from sense-feelings. As a result of the gradual elimination of opposing motives, there are intellectual, moral, and aesthetic, as well as simple sensuous, impulsive acts.

Volition
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mechan

This regressive development is but one step in a process which unites all the external acts of living being, whether they are volitional acts automatic reflex movements. When or the habituating practice of certain acts is carried further, the determining motives finally become, even in impulsive acts, weaker and more transient. The external stimulus originally aroused a strongly affective idea which operated as a motive, but now the stimulus causes the discharge of the act before it can arouse an idea. In this way the impulsive movement finally becomes an *automatic* movement. The more often this automatic movement is repeated, the easier it, in turn, becomes, even when the stimulus is not sensed, as, for example, in deep sleep or during complete diversion of the attention. The movement now appears as a pure physiological reflex, and the volitional process has become a simple *reflex process*.

This gradual *reduction of volitional to mechanical processes*, which depends essentially on the elimination of all the psychical elements between the beginning and end of the act, may take place either in the case of movements that were originally impulsive, or in the case of movements which have become impulsive through the retrogradation of voluntary acts. It is not improbable that all the reflex movements of both animals and men originate in this way. As evidence or this we have, besides the above described reduction of volitional acts through practice to pure mechanical processes, also the *purposeful character of reflexes*, which points to the presence at some time of purposive ideas as motives. Furthermore, the fact that the movements of the lowest animals are all evidently simple volitional acts, not reflexes, tells for the same view, so that here too there is no justification for the assumption frequently made that acts of will have been developed from reflex movements. Finally, we can most easily explain from this point of view the fact mentioned in § 13 (p. 189), namely, that *expressive movements* may belong to any one of the forms possible in the scale of external acts. Obviously the simplest movements are impulsive acts, while many complicated pantomimetic movements probably came originally from voluntary acts which passed first into impulsive and then into reflex movements. Observed phenomena make it necessary to assume that the retrogradations that begin in the individual life are gradually carried further through the transmission of acquired dispositions, so that certain acts which were originally voluntary may appear from the first in later descendants as impulsive or reflex movements (§ 19 and § 20).

Aulegues] Henry J Hill

10a. For reasons similar to those given in the case of emotions, the observation of volitional processes which come into experience by chance, is an inadequate and easily misleading method for establishing the actual facts in the case. Wherever internal or external volitional acts are performed in meeting either the theoretical or practical demands of life, our interest is too much taken up in the action itself to allow us at the same time to observe with exactness the psychical processes that are going on. In the theories of volition given by older psychologists — theories that very often cast their shadows in the science of to-day — we have a clear exhibition of the undeveloped state of the methods of psychological observation. External acts of will are the only ones in the whole sphere of volitional processes that force themselves emphatically on the attention of the observer. As a result the tendency was to limit the concept will to external volitional acts, and thus not only to neglect entirely the whole sphere so important for the higher devolopment of will, namely, internal volitional acts, but also to pay very little attention to the components of the volition which are antecedent to the external acts, or at most to pay attention only to the more striking ideational components of the motive. It followed that the close genetic interconnection between impulsive and voluntary acts was not observed, and that the former were regarded as not belonging to will, but as closely related to reflexes. Will was thus limited to the voluntary and selective actions. Furthermore, the one-sided consideration of the ideational components of the motives led to a complete neglect of the development of volitional acts from emotions, and the singular idea found acceptance that volitional acts are not the products of antecedent motives and of psychical conditions which act upon these motives and bring one of them into the ascendency, but that volition is a process *apart* from the motives and independent of them, a product of a metaphysical volitional faculty. This faculty was, on the ground of the limitation of the concept volition to voluntary acts, even defined as the choosing faculty of the mind, or as the faculty for preferring *one* from among the various motives that influence the mind. Thus, instead of deriving volition from its antecedent psychical conditions, only the final result, namely, the volitional act, was used to build up a general concept which was called *will*, and this class-concept was treated in accordance with the faculty-theory as a first cause from which all concrete volitional acts arise.

It was only a modification of this abstract theory when

SCHOPENHAUER and, following him, many modern psychologists and philosophers declared that volition in itself is an "unconscious" occurrence which comes to consciousness only in its result, the volitional act. In this case, obviously, the inadequate observation of the volitional process preceding the act, has led to the assumption that no such process exists. Here, again, the whole variety of concrete volitional processes is supplanted by the concept of a *single* unconscious will, and the result for psychology is the same as before: in place of a comprehension of real psychical processes and their combination, an abstract concept is set up and then erroneously looked upon as a general cause.

Modern psychology and even experimental psychology is still to a great extent under the control of this deep-rooted abstract doctrine of will. In denying from the first the possibility of explaining an act by the concrete psychical causality of the antecedent volitional process, this theory leaves as the only characteristic of an act of will the sum of the sensations which accompany the external act, or may, in cases where the act has often been repeated, immediately precede the act as pale memory-images. The physical excitations in the nervous system are regarded as the causes of the act. Here, then, the question of the causality is taken out of psychology and given over to physiology instead of to metaphysics, as in the theory discussed before. In reality, however, it is here too lost in metaphysics in attempting to cross to physiology. For physiology must, as an empirical science, abandon the attempt to give a complete causal explanation of the physical processes accompanying a complex volitional act, from the antecedents of these processes, not only for the present, but for all time, because this leads to the problem of an infinite succession. The only possible basis for such a theory is, therefore, the principle of materialistic metaphysics, that the so-called material processes are all that make up the reality of things and that psychical processes must accordingly be explained from material processes. But it is an indispensable principle of psychology as an *empirical* science, that it shall investigate the facts of psychical processes as they are presented in immediate experience, and that it shall not examine their interconnections from points of view which are entirely foreign to the facts themselves (§ 1 and p. 18 sq.). It is impossible to find out how a volition proceeds, in any way other than by following it exactly as it is presented to us in immediate experience. In this experience, however, volition is not presented as an abstract concept, but as concrete single volitions. Of any particular volition, too, we know nothing except what is immediately perceptible in the process. We can know nothing of an unconscious or, what amounts to the same thing for psychology, a material process which is not immediately perceived but merely assumed hypothetically on the basis of metaphysical presuppositions. Such metaphysical assumptions are obviously mere devices to cover up an incomplete or entirely wanting psychological observation.

References. Review of the chief Theories of Volition: VOLKMANN, Lehrbuch der Psychologie, vol. II, § 147 (Herbartian Intellectualism). BAUMANN, Handbuch der Moral, 1879, and Philos. Monatshefte, vol. 17 (ordinary view). MÜNSTERBERG, Die Willenshandlung, 1888 (psychophysical materialism). In opposition to all these theories see WUNDT, Philos. Studien, vols. 1 and 6, and Lectures on Hum. and Animal Psych., lectures 14 and 15.

Temporal course of volitions

11. The exact observation of volitional processes is, for the reasons given above, impossible in the case of volitional acts that come naturally in the course of life; the only way in which a thorough psychological investigation can be made, is, therefore, through *experimental* observation. To be sure, we can not produce volitional processes of every kind whenever we wish to do so, but we must limit ourselves to the observation of such processes as can be easily influenced through external means, namely, such as begin with external stimulations and terminate in external acts. The experiments which serve this purpose are called reaction experiments. They may be described in their essentials as follows. A volitional process of simple or complex character is incited by an external sense-stimulus and then after the occurrence of certain psychical processes which serve in part as motives, the

volition is brought to an end by a motor reaction. Reaction experiments have a second and more general significance in addition to their significance as means for the analysis of volitional processes. They furnish means for the measurement of the *rate* of certain psychical and psycho-physical processes.

The simplest reaction experiment that can be tried is as follows. A short interval (2—3 sec.) after a signal that serves to concentrate the attention, an external stimulus is allowed to act on some sense-organ. At the moment when the stimulus is perceived, a movement that has been determined upon and prepared before, as, for example, a movement of the hand, is executed. The psychological conditions in this experiment correspond essentially to those of a *simple* volition. The sense impression serves as a simple motive, and this is to be followed invariably by a particular act. If now we measure objectively by means of either graphic or other chronometric apparatus, the interval that elapses between the action of the stimulus and the execution of the movement, it will be possible, by frequently repeated experiments of the same kind, to become thoroughly acquainted with the subjective processes that make up the whole reaction, while at the same time the results of the objective measurement will furnish a check for the constancy or possible variations in these subjective processes. This check is especially useful in those cases where some condition in the experiment, and thereby the subjective course of the volition itself, is intentionally modified.

[illegible] Reaction

12. Such a modification may, indeed, be introduced even in the simple form of the experiment just described, by varying the way in which the reactor *prepares*, before the appearance of the stimulus, for the execution of the act. When the preparation is of such a character that expectation is directed toward the stimulus which is to serve as a

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motive, and the external act does not take place until the stimulus is clearly recognized, there results a *complete* form of reaction, or the form known as *sensorial* reaction. When, on the other hand, the preparatory expectation is so directed toward the motive which is to arouse the act, that the movement follows the reception of the stimulus as rapidly as possible, there results a *shortened* form of reaction, or the so-called *muscular* reaction. In the first case the ideational factor of the expectation is a pale memory image of the familiar sense impression. When the period of preparation is more extended, this image oscillates between alternating clearness and obscurity. The affective element is a feeling of expectation that oscillates in a similar manner and is connected with sensations of strain from the sense-organ to be affected, as, for example, with tension of the tympanic membrane, or of the ocular muscles of accommodation and movement. At the moment when the impression arrives the preparatory feelings mentioned are followed by a comparatively weak relieving feeling of surprise. This surprise in turn gives place to a clearly subsequent arousing feeling of activity which accompanies the reaction movement and appears in conjunction with the inner tactual sensations. In the second case, on the other hand, where the reaction is of the shortened form, we may observe during the period of preparatory expectation a pale, wavering memory image of the *motor organ* which is to react (*e. g.*, the hand) together with strong sensations of strain in the same, and a fairly continuous feeling of expectation connected with these sensations. At the moment when the stimulus arrives the state of expectation gives place to a strong feeling of surprise. There connects itself, then, with this surprise both the feeling of activity which accompanies the reaction and also the sensations that arise in the reaction. So rapid is this connection that the surprise and the subsequent state are not distinguished at all, or at most only very vaguely. *Complete* reaction-time is on the average 0.210—0.290 sec. (the shortest time is for sound, the longest for light), with a mean variation of 0.020 sec. for the single observations. *Shortened* reaction-time is 0.120—0.190 sec., with a mean variation of 0.010 sec. The different values of the mean variation in the two cases are chiefly important as objective checks for the discrimination of these forms of reaction[1]).

gher Forms
Volition

13. By introducing special conditions we may make complete and shortened reactions the starting points for the study of the *development of volitions* in two different directions. *Complete* (sensorial) reactions furnish the means of passing from simple to complex volitions because we can in this case easily insert different psychical processes between the perception of the impression and the execution of the reaction. Thus we have a *voluntary act* of relatively simple character when we allow an act of cognition or discrimination to follow the perception of the impression and then let

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1) Complete and shortened forms of reaction are further distinguished by the characteristic fact that in long series of these two classes of reactions no *early reactions* or *mistaken reactions* appear among the complete reactions, while they are very frequent among the shortened reactions. Both early reactions and mistaken reactions may be observed when the true stimulus is, in frequently repeated experiments, preceded at a uniform interval by a preparatory signal. An early reaction is one in which the reactor moves his hand *before* the arrival of the signal agreed upon. A mistaken reaction is one in which the reactor moves in response to some accidental sensory stimulus. The reaction-times for sensations of taste, smell, temperature, and pain are not reckoned in the figures given. They are all longer. The differences are, however, obviously to be attributed to purely physiological conditions (slow transmission of the stimulation to the nerve-endings, and in the case of pain slower central conduction), so that they are of no very great interest for psychology.

the movement depend on this second process. In this case, not the immediate impression, but the idea that results from the act of cognition or discrimination is the motive for the act to be performed. This motive is only one of a greater or smaller number of equally possible motives that could have come up in place of it; as a result the reaction movement takes on the character of a voluntary act. In fact, we may observe clearly the feeling of *resolution* antecedent to the act and also the feelings preceding the feeling of resolution and connected with the perception of the impression. This is still more emphatically the case, and the succession of ideational and affective processes is at the same time more complicated, when we bring in still another psychical process, as, for example, an association, to serve as the motive for the execution of the movement. Finally, the voluntary process becomes one of *choice* when, in such experiments, the act is not merely influenced by a plurality of motives in such a way that several must follow one another before one determines the act, but when, in addition to that, *one* of a number of possible different acts is decided upon according to the motive presented. This takes place when preparations are made for different movements, for example, one with the right hand, another with the left hand, or one with each of the ten fingers, and the condition is prescribed for each movement that an impression of a particular quality shall serve as its motive, for example, the impression blue for the right hand, red for the left. (Reactions become automatic

14. *Shortened* (muscular) reactions, on the contrary, may be used to investigate the *retrogradation of volitional acts* as they become reflex movements. In this form of reaction the preparatory expectation is directed entirely towards the external act which is to be executed as rapidly as possible, so that voluntary inhibition or execution of the act in ac-

cordance with the special character of the impression can here not take place. In other words, a transition from simple to complex acts of will, is in this case impossible. On the other hand, it is easy by practice so to habituate one's self to the invariable connection of an impression and a particular movement, that the process of perception fades out more and more or takes place after the motor impulse, so that finally the movement becomes just like a reflex movement. This reduction of volition to a mechanical process, shows itself objectively most clearly in the shortening of the objective time to that observed for pure reflexes, and shows itself subjectively in the fact that for psychological observation there is a complete coincidence in point of time, of impression and reaction, while the characteristic feeling of resolution gradually disappears entirely.

Gen. Signif. of Reaction Expts

14a. The chronometric experiments familiar in experimental psychology under the name of "reaction experiments", are important for two reasons: first, as aids in the analysis of volitional processes, and secondly, as means for the investigation of the temporal course of psychical processes in general. This twofold importance of reaction experiments reflects the central importance of volitions. On the one hand, the simpler processes, feelings, emotions, and their related ideas, are components of a complete volition; on the other, all possible forms of the interconnection of psychical compounds may appear as components of a volition. Volitional processes are, consequently, appropriate subjects to form the links between what has gone before and the topic to be discussed in the next chapter, namely, the interconnection between psychical compounds.

For a "reaction experiment" which is to be the basis of an analysis of a volitional process or any of its component psychical processes, we must have first of all exact and sufficiently fine (reading with exactness to $\frac{1}{1000}$ sec.) *chronometric apparatus* (electric clock or graphic register). The apparatus must be so arranged that we can determine exactly the moment at which the stimulus acts and that at which the subject reacts. This can be accomplished by allowing the stimulus itself (sound, light, or tactual stimulus), to close an electric current that sets an electric clock, reading to $\frac{1}{1000}$ sec., in motion, and then allowing the observer, by means of a simple movement of the hand which raises a telegraph-key, to break the current again at the moment at which he perceives the stimulus. In this way we may measure simple reactions varied in different ways (complete and shortened reactions, reactions with or without preceding signals), or we may bring into the process various other psychical acts (discriminations, cognitions, associations, selective processes) which may be regarded either as motives for the volition or as components of the general interconnection of psychical compounds. A simple reaction always includes, along with the volitional process, purely physiological factors (conduction of the sensory excitation to the brain and of the motor excitation to the muscle). If, now, we insert further psychical processes (discriminations, cognitions, associations, acts of choice), a modification which can be made only when *complete* reactions are employed, the duration of clearly definable psychical processes may be gained by subtracting the interval found for simple reactions from those found for the compound reactions. In this way it has been determined that the time required for the cognition and for the discrimination of relatively simple impressions (colors, letters, short words) is 0.03—0.05 sec.; the time of association is 0.3—0.8 sec. The time for choice between two movements (right and left hand) is 0.06 sec., between ten movements (the ten fingers) 0.4 sec., etc. As already remarked the value of these figures is not their absolute magnitude, but rather their utility as checks for introspection. Furthermore, we may at the same time apply this introspective observation to processes subject to conditions which are prescribed with exactness by means of experimental methods and which may therefore be repeated at pleasure. One must not lose sight of the fact that as the reaction processes become more and more complex, the figures given can be less and less definitely assigned to special clearly differentiated psychical processes. Thus, a choice process or an association process is composed of a great number of elementary processes which in different individual cases are combined in different ways and appear in different degrees of completeness. The result is that the average time found by trying a large number of experiments gives a certain relative measure of the complexity of the processes, but no absolute indication of the duration of any single definitely distinguishable psychical phenomenon. In general it is to be noted that reaction experiments are among the most difficult of investigation in experimental psychology, if they are to be conducted in such a way as to have any value for psychology. They require the greatest technical care, the collection and statistical treatment of a large number of observations; and they require also the highest degree of practice in introspection. Unfortunately, these conditions are not met in all cases. Sometimes far reaching conclusions in regard to the nature of psychical processes are based upon a few cursory observations. Or else the individual differences in the reaction times of different reactors, as discovered in a few experiments, which differences carry in themselves no evidence of being anything but chance variations, are treated as "typical" differences. When the experiments are carried out with proper care these individual differences (which belong to the discussions of psychological characterology, disappear more and more. As the individual differences disappear, the influences of the variable conditions, such as differences in preparation and in the direction of attention, become more clearly apparent.

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III. INTERCONNECTION OF PSYCHICAL COMPOUNDS.

§ 15. CONSCIOUSNESS AND ATTENTION.

1. Every psychical compound is composed of a number of psychical elements which usually do not all begin or end at exactly the same moment. As a result, the interconnection which unites the elements into a single whole always reaches beyond the individual compounds, so that different simultaneous and successive compounds are united, though indeed somewhat more loosely than are the elements within a single compound. We call this interconnection of psychical compounds *consciousness*.

Consciousness, accordingly, does not mean something that exists apart from psychical processes, nor does it refer merely to the sum of these processes without reference to how they are related to one another. It is the name for the general synthesis of psychical processes, in which general synthesis the single compounds are marked off as more intimate combinations. A state in which this interconnection is interrupted, as deep sleep or a faint, is called an *unconscious* state; and we speak of "disturbances of consciousness" when abnormal changes in the combination of psychical compounds arise, even though the compounds themselves show no internal changes whatever.

absence / intermittence

Physiological Conditions

2. Consciousness stands under the same external conditions as psychical phenomena in general. Indeed, consciousness is merely another name for these phenomena, referring more particularly to the mutual relations of the components of these phenomena to one another. As the substratum for the manifestations of an individual consciousness we have in every case an individual animal organism. In the case of men and similar higher animals the cerebral cortex, in the cells and fibres of which all the organs that stand in relation to psychical processes are represented, appears as the immediate organ of this consciousness. The complete interconnection of the cortical elements may be looked upon as the physiological correlate of the interconnection of psychical processes in consciousness, and the differentiation of the functions of different cortical regions, as the physiological correlate of the great variety of single conscious processes. The differentiation of functions in the central organ is, indeed, merely relative; every psychical compound requires the cooperation of numerous elements and many central regions. When the destruction of certain cortical regions produces definite disturbances in voluntary movements and sensations, or when such a destruction interferes which the formation of certain classes of ideas, it is perfectly justifiable to conclude that these regions furnish certain indispensable links in the chain of physical processes which run parallel to the psychical processes in question. The assumptions often made on the basis of these phenomena, that there is in the brain a special organ for the faculties of speech and writing, or that visual, tonal, and verbal ideas are stored in special cortical cells, are not only the results of the grossest physiological misconceptions, but they are irreconcilable with the psychological analysis of these functions. Psychologically regarded, these assumptions are nothing but modern revivals

of that most unfortunate form of faculty-psychology known as phrenology.

2a. The facts that have been discovered in regard to the localization of certain psycho-physical functions in the cortex, are derived partly from pathological and anatomical observations on men, and partly from experiments on animals. They may be summed up as follows: 1) Certain cortical regions correspond to certain peripheral sensory and muscular regions. Thus, the cortex of the occipital lobe is connected with the retina, a part of the parietal lobe is connected with the tactual surface, and a part of the temporal lobe with the auditory organ. The central ganglia of special groups of muscles generally lie directly next to, or between the sensory centres functionally related to them. 2) Certain complex disturbances have been demonstrated as occurring when certain cortical regions which are not directly connected with peripheral organs, but are inserted between other central regions, fail to carry out their functions. The only relation of this kind which has been proved beyond a doubt, is that of a certain region of the frontal lobe to the functions of *speech*. The front part of this region is connected in particular with the articulation of words (its disturbance results in interference with motor coordination, "ataxic aphasia"), the part further back is connected with the formation of word ideas (its disturbance hinders sensorial coordination and produces in this way the so-called "amnesic aphasia"). It is also observed that these functions are as a rule confined entirely to the *left* frontal lobe and that generally apoplectic disturbances in the right lobe do not interfere with speech, while those in the left lobe do. Furthermore, in all these cases, in both simple and complex disturbances, there is usually a gradual restoration of the functions in the course of time. This is probably effected by the vicarious functioning of some, generally a neighbouring, cortical region in place of that which is disturbed (in disturbances of speech, perhaps it is the opposite, before untrained, side that comes into play). Localization of other complex psychical functions, such as processes of memory and association, has not yet been demonstrated with certainty. The name "psychical centres", applied to certain cortical regions by many anatomists, is for the present at least based exclusively either on the very questionable interpretation of experiments on animals, or else on the mere anatomical fact that no motor or sensory fibres running directly to these regions can be found, and that in general connective fibres are here developed relatively late. The cortex of the *frontal brain* is such a region. In the human brain it is noticeable for its large development. It has been observed in many cases that disturbances of this part of the brain soon result in marked inability to concentrate the attention or in other intellectual defects which are possibly reduceable to this; and from these observations the hypothesis has been made that this region is to be regarded as the seat of the function of *apperception* which will be discussed later (4), and of all those components of psychical experience in which, as in the feelings, the unitary interconnection of mental life finds its expression (comp. p. 99). This hypothesis requires, however, a firmer empirical foundation than it has at present. It is to be noted that certain cases which differ from the first ones mentioned, in the fact that a partial injury of the frontal lobe is sustained without any noticeable disturbance of intelligence, are by no means proofs against this hypothesis. There is much evidence to show that just here, in the higher centres, local injuries may occur without any apparent results. This is probably due to the great complexity of the connections and to the various ways in which the different elements can, therefore, take the places of one another. The expression "centre" in all these cases is, of course, employed in the sense that is justified by the general relation of psychical to physical functions, that is, in the sense of a parallelism between the two classes of elementary processes, the one regarded from the point of view of the natural sciences, the other from that of psychology (comp. p. 2 and § 22, 9).

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Simultaneous and successive interconnecti
Conscious Processes

3. The interconnection of psychical processes, which constitutes what we understand under the concept consciousness, is in part a simultaneous, in part a successive interconnection. The sum of all the processes present at a given moment is always a unitary whole whose parts are more or less closely united. This is what constitutes the *simultaneous* interconnection. On the other hand, a present state is derived directly from that which immediately preceded it, in one of two ways. a Either certain processes disappear and others change their course and still others arise, b or else a state of unconsciousness intervenes and the new processes are brought into relation with those which were present before. These are what constitute *successive* interconnections. In all these cases the scope of the single combinations between preceding and following processes determines the state of consciousness. Consciousness gives place to unconsciousness when this interconnection is completely interrupted, and it is more incomplete the looser the connection between the processes of the moment and those preceding it. Thus, after a period of unconsciousness the normal state of consciousness is generally only slowly recovered through a gradual reestablishment of relations with earlier experiences.

So we come to distinguish *grades* of consciousness. The lower limit, or zero grade, is unconsciousness. This condition, which consists in an absolute absence of all psychical interconnections, is essentially different from the *disappearance of single psychical contents from consciousness.* The latter is continually taking place in the flow of mental processes. Complex ideas and feelings and even single elements of these compounds may disappear, and new ones take their places. Any psychical element that has disappeared from consciousness, is to be called *unconscious* in the sense that we assume the possibility of its renewal, that is, its reappearance in the

[illegible]

actual interconnection of psychical processes. Our knowledge about an element that has become unconscious does not extend beyond this possibility of its renewal. For psychology, therefore, it has no meaning except as a *disposition* for the rise of future components of psychical processes, which components are connected with earlier conscious processes. Assumptions as to the state of the "unconscious" or as to "unconscious processes" of any kind which are thought of as existing along with the conscious processes of experience, are entirely unproductive for psychology. There are, of course, *physical* concomitants of the psychical dispositions mentioned, of which some can be directly demonstrated, some inferred from various experiences. These physical concomitants are the effects which *practice* produces on all organs, especially on the organs of the nervous system. As a universal result of practice we observe a *facilitation of action* which renders a repetition of the process easier. To be sure, we do not know any details in regard to the changes that are effected in the structure of the nervous elements through practice, but we can represent them to ourselves through very natural analogies with mechanical processes, such, for example, as the reduction of friction resulting from the rubbing of two surfaces against each other.

perception
7/
attention

4. It was noted in the case of temporal ideas (p. 168), that the member of a series of successive ideas which is immediately *present* in our perception, has the most favorable position. Similarly in the simultaneous interconnection of consciousness, for example in a compound clang or in a series of spacial objects, certain single components are favored above the others. In both cases we designate the differences in the perception as differences in *clearness* and *distinctness*. Clearness is the relatively favorable recognition of the content in itself, distinctness the sharp discrimination from other objects.

Variable

Properties { Clearness
distinctness

apperception - has all the characteristic of a volitional act.

Distinctness is generally connected with clearness. The state which accompanies the clear grasp of any psychical content and is characterized by a special feeling, we call *attention*. The process through which any content is brought to clear comprehension we call *apperception*. In contrast with this, perception of content which is not accompanied by a state of attention, we designate *apprehension*. Those contents of consciousness upon which the attention is concentrated are spoken of, after the analogy of the external optical experiences of fixation, as being at the *fixation-point of consciousness*, or at the *inner fixation-point*. On the other hand, the whole content of consciousness at any given moment is called the *field of consciousness*. When a psychical process passes into an unconscious state we speak of its *sinking below the threshold of consciousness* and when a psychical process arises we say it *appears above the threshold of consciousness*. These are all figurative expressions and must not be understood literally. They are useful, however, because of the brevity and clearness they permit in the description of conscious processes. degree of clearness of contents of [illegible]

5. If we try to describe the train of psychical compounds in their interconnection, with the aid of these expressions, we may say that this train of compounds is made up of a continual coming and going. At first some compound comes into the field of consciousness and then advances into the inner fixation-point, from which it returns to the field of consciousness before disappearing entirely. Besides this train of psychical compounds all of which are apperceived, there is also a coming and going of other compounds which are merely apprehended, that is, there are compounds which enter the field of consciousness and pass out again without reaching the inner fixation-point. Both the apperceived and the apprehended compounds may have different grades of

clearness. In the case of apperceived compounds this appears in the fact that the clearness and distinctness of apperception in general is variable according to the state of consciousness. To illustrate: it can easily be shown that when one and the same impression is apperceived several times in succession, if the other conditions remain the same, the successive apperceptions are usually clearer and more distinct. The different degrees of clearness in the case of compounds that are merely apprehended, may be observed most easily when the impressions are composite. It is then found, especially when the impressions last but an instant, that even here, where all the components are obscure from the first, there are still different gradations. Some seem to rise more above the threshold of consciousness, some less.

ew repeated
ing times
is clearer

Scope of attention a
Consciou

6. These relations can not be determined with certainty through chance introspections, they require systematic experimental observations. The best kinds of conscious contents to use for such observations are *ideas* because they can be easily produced at any time through external impressions. Now, in any temporal idea, as already remarked (§ 11, p. 168), those components which belong to the *present* moment are in the fixation-point of consciousness. Those of the preceding impressions which were present shortly before, are still in the field of consciousness, while those which were present longer before, have disappeared from consciousness entirely. A spacial idea, on the other hand, when it has only a limited extent, may be apperceived at once in its totality. If it is more composite, then its parts too, must pass successively through the inner fixation-point if they are to be clearly perceived. It follows, therefore, that composite *spacial* ideas (especially momentary visual impressions) are peculiarly well suited to furnish a measure of the amount of content that can be *apperceived* in a single act, or of the

deas best

[illegible]
[illegible]
for
[illegible]

scope of attention; while composite temporal ideas (for example, rhythmical auditory impressions, hammer-strokes) may be used for measuring the amount of content that can enter into consciousness at a given moment, or the *scope of consciousness*. Experiments made in this way give, under different conditions, a scope of from 6 to 12 simple impressions for attention and of 16 to 40 such impressions for consciousness. The smaller figures hold for those impressions which do not unite at all to form ideational combinations, or at most unite very incompletely, while the larger figures hold for those impressions in which the elements combine as far as possible into composite compounds.

6a. The most accurate way of determining the *scope of attention* is to use spacial impressions of sight, for in such cases it is very easy, by means of an electric spark, or by means of the fall of a screen made with an opening in the centre, by means of a tachistoscope, to expose the objects for an instant and in such a way that they all lie in the region of clearest vision. In these experiments there must be a point for fixation before the momentary illumination, in the middle of the surface on which the impressions are to appear. Immediately after the experiment, if it is properly arranged, the observer knows that the number of objects which were clearly seen in a physiological sense, is greater than the number included within the scope of attention. When, for example, a momentary impression is made up of letters, it is possible, by calling up a memory image of the impression, to read afterwards some of the letters that were only indistinctly recognized at the moment of illumination. This memory image, however, is clearly distinguished in time from the impression itself, so that the determination of the scope of attention is not disturbed by it. It is true, rather, that careful introspection easily succeeds in fixating the state of consciousness at the moment the impression arrives, and in distinguishing this from the subsequent acts of memory, which are always separated from it by a noticeable interval. Experiments made in this way show that the scope of attention is by no means a constant magnitude, but that, even when the concentration of the attention is approximately at its maximum, its scope depends in part on the simplicity or complexity of the impressions, in part on their familiarity. The simplest spacial impressions are arbitrarily distributed points. Of these a maximum of six can be apperceived at one time. When the impressions are somewhat more complex, but of a familiar character, such as simple lines, figures and letters, six are, as a rule, perceived simultaneously. The figures just given hold for vision; for touch the same limits seem to hold only in the case of the simplest impressions, namely, points. Six such simple impressions can, under favorable conditions, be apperceived in the same instant. This fact has been made use of in a practical way in the blind alphabet made with points (p. 119). For both touch and vision the number of familiar ideas that can be grasped at once decreases as the complexity increases. In such cases, however, it should be noted that the total number of elements increases in spite of the decrease in the number of separate total ideas. Thus, when nonsense syllables are used, from six to ten letters can be apperceived at once. Familiar phrases and proverbs may appear to be apperceived in a much more extensive way. Indeed, sometimes apperception seems to include four or five short words with a total of twenty or thirty letters. In these cases, however, the process of apperception is decidedly complicated by the fact that assimilation (which will be discussed in § 16) makes itself felt in a very marked degree. If assimilation is checked by a closer concentration of the attention upon the impression itself, the scope of attention is again reduced even for these familiar groups of words to about the same limits as those which appear in the case of separate impressions. Another group of conditions under which the scope of attention seems to be much enlarged is the group of conditions presented when impressions are given for a relatively longer period of time, so that the attention finds opportunity to pass from point to point, thus approximating the conditions which arise in ordinary reading. If, however, these complications of successive observation, and the above mentioned complications of reproductive association, are all eliminated, the maximum scope of attention for both vision and touch seems to be expressed by the figures given at first. The scope of attention includes from four to six simple impressions. Under any conditions, then, the assertion sometimes made that attention can be concentrated on only *one* impression, or one idea at a time, is false.

Then too, the observations overthrow the assumption that the attention can sweep continuously and with great rapidity over a great number of single ideas. In the experiment described, if the attempt is made to fill up from memory the image which is clearly perceived an instant after the impression, a very noticeable interval is required to bring into clear consciousness an impression that was not apperceived at first. The successive movement of attention over a number of objects appears accordingly, to be a *periodic* process, made up of a number of separate acts of apperception following one another. Such a *periodic rise and fall of attention* can, under favorable conditions, be directly demonstrated. It is generally irregular in its periods, but when there are special conditions favoring rhythmical succession the periods may become regular. Thus, if we allow a weak continuous impression to act on a sense organ and remove as far as possible all other stimuli, it will be observed when the attention is concentrated upon this impression that at certain, generally irregular, intervals, the impression becomes for a short time indistinct, or even appears to fade out entirely, only to appear again the next moment. This wavering begins, when the impressions are very weak, after 3—6 seconds; when they are somewhat stronger, after 18—24 seconds. These variations are readily distinguished from changes in the intensity of the stimulus itself, as may be easily demonstrated by purposely weakening or interrupting the stimulus in the course of the experiment. There are *two* characteristics that distinguish the subjective variations from those due to the changes in the stimulus. First, so long as the impression merely passes through subjective variations there is always an idea of the continuance of the impression, just as there was in the experiments with momentary impressions an indefinite and obscure idea of the components which were not apperceived. Secondly, the oscillations of attention are attended by characteristic feelings and sensations which are added to the increasing and decreasing clearness of the impressions, and which are entirely absent when the changes are objective. The characteristic feelings are those of expectation and activity, which will be described later and which regularly increase with the concentration of attention and decrease with its relaxation. The sensations come from the sense-organ affected, or at least emanate indirectly from it. They consist in sensations of tension in the tympanic membrane or in sensations of accommodation and convergence, etc. These two series of characteristics distinguish the concepts, clearness and distinctness of psychical contents from the concept intensity of sensational elements. A strong impression may be obscure and a weak one clear. The only relation between these two different concepts is to be found in the fact that in general the stronger impressions force themselves more upon apperception. Whether or not they are really more clearly apperceived, depends on the other conditions present at the moment. The same is true of the advantages possessed by those parts of a visual impression which fall within the region of clearest vision. As a rule, the fixated objects are also the ones apperceived. But, in the experiments with momentary impressions described above, it can be shown that this interconnection may be broken up. This happens when we voluntarily concentrate our attention on a point in the eccentric regions of the field of vision. The object which is *obscurely seen* then becomes the one which is *clearly ideated.*

6b. In the same way that momentary spacial impressions are used to determine the scope of attention, we may use impressions which succeed one another in time, as a measure of the *scope of consciousness.* In this case we start with the assumption that a series of impressions can be united in a single unitary idea only when they are all together in consciousness, at least for one moment. If we listen to a series of hammer-strokes, it is obvious that while the present sound is apperceived, those immediately preceding it are still in the field of consciousness. Their clearness diminishes, however, just in proportion to their distance in time from the apperceived impression, and those lying beyond a certain limit disappear from consciousness entirely. If we can determine this limit, we shall have a measure of the scope of consciousness under the special condition given in the experiment. As a means for the determination of this limit we may use the ability to compare temporal ideas which follow one another immediately. So long as such a more or less complex idea is present in consciousness as a single unitary whole, we can compare a succeeding idea with it and decide whether the two are alike or not. On the other hand, such a comparison is absolutely impossible when the preceding temporal series is not a unitary whole for consciousness, that is, when a part of its constituents have passed into unconsciousness before the end is reached. Thus, we may produce in immediate succession two series of strokes by means of a metronome, marking off each series by a signal at its beginning with a bell-stroke. When now, these two series are perceived, we can judge directly from the impression, so long as the strokes of the given series can be grasped as single wholes in consciousness, whether the two series are alike or not. Of course, in such experiments counting of the strokes must be strictly avoided. In making the judgments it may be noticed that the impression of likeness is produced by the same affective elements as in the temporal ideas mentioned before (p. 170). Every stroke in the second series is preceded by a feeling of expectation corresponding to the analogous stroke of the first series, so that every stroke too many or too few produces a feeling of disappointment due to the disturbance of the expectation. It follows that it is not necessary for the two successive series to be present in consciousness at the same time in order that they may be compared; but what is required is the union of all the impressions of *one* series into a single unitary idea. The relatively fixed boundary of the scope of consciousness is clearly shown in the fact that the likeness of two temporal ideas is always recognized with certainty so long as these ideas do not pass the bound that holds for the conditions under which they are given, while the judgment becomes absolutely uncertain when this limit is once crossed. The extent of the scope of consciousness as found in measurements made when the conditions of attention remain the same, depends partly on the rate of the successive impressions and partly on their more or less complete rhythmical combination. When the rate of succession is slower than about one every four seconds, it becomes impossible to combine successive impressions into a temporal idea; by the time a new impression arrives, the preceding one has already disappeared from consciousness. When the rate passes the upper limit of about one every 0.12 sec., the formation of distinctly defined temporal ideas is impossible because the attention can not follow the impressions any longer. The most favorable rate is a succession of strokes, one every 0.2—0.3 sec. With this rate and with the simplest rhythm of $^2/_8$ time which generally arises of itself when the perception is uninfluenced by any special objective conditions, as a rule, 8 double or 16 single impressions can be just grasped together. The best rhythm for the perception in one group of the greatest possible number of single impressions is the $^4/_4$-measure with the strong accent on the first stroke and the medium accent on the fifth. In this case a maximum of five feet or forty single impressions, can be grasped at once. If these figures are compared with those obtained when the scope of attention was measured (p. 231), putting simple and compound temporal impressions equal to the corresponding spacial impressions, we find that the scope of consciousness is about four times as great as that of attention.

References. On the Scope of Attention: CATTELL, Philos. Studien, vol. 3. ZEITLER, Philos. Studien, vol. 16. On Fluctuation of Attention: N. LANGE, Philos. Studien, vol. 4. ECKNER, PACE, Philos. Studien, vol. 8. On the scope of consciousness: DIETZE, Philos. Studien, vol. 2. WUNDT, Grundzüge der phys. Psych., vol. II, chap. 15, and Lect. on Hum. and Anim. Psych., lectures 16 and 17 (Fig. 41 Tachistoscope, Fig. 43 Measure of the scope of consciousness).

ffective Influence of Conscious contents wh. are merely appe

7. Besides the properties of clearness and distinctness which belong to conscious contents in themselves or in their mutual relations to one another, there are regularly other properties which are immediately recognized as *accompanying processes*. These are partly feelings which are characteristic of particular forms of apprehension and apperception, partly sensations of a somewhat variable character. Especially the ways in which psychical contents *enter the field of consciousness*, and the way in which they enter the fixation-point of consciousness, vary according to the different conditions under

which the entrance takes place. When any psychical process rises above the threshold of consciousness, it is the affective elements which, as soon as they are strong enough, are what first become noticeable. They begin to force themselves energetically into the fixation-point of consciousness before anything is perceived of the ideational elements. This is the case whether the impressions are new or are revivals of earlier processes. This is what causes those peculiar states of mind the reasons for which we are usually unable to discover. They are sometimes states of a pleasurable or unpleasurable character, sometimes they are predominantly states of strained expectation. In this latter case the sudden entrance into the scope of the attention of the ideational elements belonging to the feelings, is accompanied by feelings of relief or satisfaction. When we are trying to recall something that has been forgotten, this affective state may arise. Often there is vividly present in such a case, besides the regular feeling of strain, the special affective tone of the forgotten idea, although the idea itself still remains in the background of consciousness. In a similar manner, as we shall see later (§ 16), the clear apperception of ideas in acts of cognition and recognition is always preceded by special feelings. Similar affective states may be produced experimentally by the momentary illumination of a field of vision in which there are in the region of indirect vision, impressions of the strongest possible affective tone. All these experiences seem to show that every content of consciousness has some influence on attention. Every content thus shows itself partly through its own proper affective tone, and partly through the feelings connected with acts of attention. The whole effect of these obscure contents of consciousness on the attention fuses, according to the general law of the synthesis of affective components (p. 175), with the feelings attending the clearly conscious contents, thus forming a single total feeling. feeling of apperception

8. When any psychical content enters the *fixation-point* of consciousness, new and peculiar affective processes are added to those that have been described. These new feelings are in turn of different kinds, according to the different conditions attending the entrance of the content into the fixation-point. The conditions are of two classes and are related for the most part, to the above described preparatory affective influences of the content before it is apperceived.

First, the new content may force itself on the attention suddenly and without preparatory affective influences; this we call *passive apperception.* While the content of consciousness is becoming clearer both in its ideational and affective elements, there is first of all a concomitant feeling of *passive receptivity*, which is a depressing feeling, and is generally stronger the more intense the psychical process, and the more rapid its rise. This feeling soon sinks and then gives place to an antagonistic, exciting feeling of *activity.* There are connected with both these feelings characteristic sensations in the muscles of the sense-organ from which the ideational components of the process proceed. The feeling of receptivity is accompanied by a transient sensation of relaxation, that of activity by a succeeding sensation of strain.

[illegible] perception [illegible]

Secondly, the new content may be preceded by the preparatory affective influences mentioned above (7), and as a result the attention may be concentrated upon this content even before it arrives; this we call *active apperception.* In such a case the apperception of the content is preceded by a feeling of *expectation*, sometimes of longer, sometimes of shorter duration. This feeling is generally one of strain and may at the same time be one of excitement; it may also have pleasurable or unpleasurable factors, according to its

Passive apperception
Impulsive volition

Becoming clearer [illegible] feeling of passive [illegible]
sinks & the exciting feeling of activity = Strain

Attention concentrated before its arrival
preceded by expectation = [illegible] excitement
When it arrives in clear consciousness [illegible]
[illegible] feeling [illegible] depressing, exciting state

ideational elements. This feeling of expectation is usually accompanied by fairly intense sensations of tension in the muscles of the sense-organ affected. At the moment in which the content arises in clear consciousness, this feeling gives place to a feeling of *fulfillment* which is generally very short and has the character of a feeling of relief. Under circumstances it may also be depressing or exciting, pleasurable or unpleasurable. After this feeling of fulfillment, we have at once the feeling of *activity.* This is the same feeling as that which appeared at the close of passive apperception, and is here, as it was there, attended by an increase in the feelings of strain.

8a. The experimental observation of the different forms of apperception can be carried out best with the aid of the reaction-experiments described in § 14. Passive apperception may be studied by the use of unexpected impressions, and active, by the use of expected impressions. At the same time it will be observed that between these typical differences there are intermediate stages. Either the passive form will approach the active because of the weakness of the first stage, or the active will approach the passive form because in the sudden relaxation of the expectation the contrast between the expectation and the relief and depression which come in the succeeding feeling of fulfillment, is more marked than usual.

Interconnection of Attention & Volition

9. If the affective side of these processes of attention is more closely examined, it appears that the affective elements are exactly the same as in the case of all *volitional processes.* It is also clear that in its essential character passive apperception corresponds to an impulsive act while the active form of apperception corresponds to a voluntary act. In the first case the psychical content which forces itself upon attention without preparation is evidently the single motive, and therefore arouses the act of apperception without any conflict

1st = Impulse

|| parall

with other motives. The act is here too connected with the feeling of activity characteristic of all volitional acts. In the case of active apperception, on the other hand, other psychical contents with their affective elements tend to force themselves upon the attention during the preparatory affective stages, so that the act of apperception when it finally is performed is often recognized as a voluntary process. It may even be recognized as a selective process when the conflict between different contents comes clearly into consciousness. The existence of such selective acts under the circumstances mentioned was recognized even in older psychology where "voluntary attention" was spoken of. But here too, as in the case of external volitional acts, will was made to stand alone; there was no explanation of it by its antecedents, because the central point in the development, namely, the fact that so-called involuntary attention is only a simpler form of internal volition, was entirely overlooked. Then, too, in accordance with the methods of the old faculty-theory, "attention" and "will" were regarded as different, sometimes as related forces, sometimes as mutually excluding psychical forces, while the truth evidently is that these two concepts refer to the same class of psychical processes.

[illegible]

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10. In connection with these internal volitional acts which we call processes of attention, there takes place the formation of certain concepts of the highest importance for all psychical development. This is the formation of the concept *subject* and the establishment of the correlate concept objects, as independent realities standing over against the subject. The full formation of these concepts can be carried out in logical form only with the aid of scientific reflection, still the concepts have their bases in the processes of attention.

Even in immediate experience there is a division between components of this experience. On the one hand are those components which are arranged in space with relation to the point of orientation mentioned above (p. 144), and are either called *objects*, that is, something outside the perceiving subject, or are called with reference to the mode of their rise in consciousness, *ideas*, that is something which the subject perceives. On the other hand, there are other components of experience which do not belong to this spacial order, though they are continually brought into relation with it through their quality and intensity. These latter components as we saw in § 12—14, are intimately interconnected. *Feelings* are parts of *emotions* and emotions are to be considered as components of *volitional processes*. Any such process may end before it is fully completed, as is often the case when a feeling gives rise to no noticeable emotion, or when an emotion fades out without really causing the volitional act for which it prepared the way. All affective processes may, then, be subsumed under the general concept *volitional process*. Volition is the complete process of which the other two are merely components of simpler or more complex character. From this point of view we can easily understand how it is that even simple feelings contain, in the extremes between which they vary, a volitional direction; and that these same feelings express by ~~their tendencies~~ the amount of volitional energy present at a given moment; and finally, that they correspond to certain particular phases of the volitional process itself. The *direction of volition* is obviously indicated by the pleasurable or unpleasurable directions of feelings, which correspond directly to an effort to reach something, or to an effort to avoid something. The amount of *volitional energy* finds its expression in the arousing and subduing directions of feelings, while the opposite *phases* of a volitional process are related to the directions of strain and relaxation.

reach [illegible] avoid
Direction – pleasurable & unpleasurable
Energy – arousing & subduing
Phase – strain & relaxation

feeling of unity carried over to volitional
because of relation of conscious contents to of volition

Self consciousness.

11. Thus, *volition* proves to be the fundamental fact from which arise all those processes which are made up of feelings. In the process of *apperception*, which is found through psychological analysis to have all the characteristics of a volitional act, we have the direct relation between this fundamental fact of volition and the *ideational contents* of experience. Now, volitional processes are recognized as being unitary processes and as being uniform in character in the midst of all the variations in their components. As a result there arises an immediate feeling of this unitary interconnection in connection with the feeling of activity which accompanies all volition. This feeling of unity is then carried over to all conscious contents because of the relation mentioned in which these conscious contents stand to volition. This feeling of the interconnection of all psychical experiences of an individual, is called the "ego". It is a *feeling*, not an idea as it is often called. Like all feelings, however, it is connected with certain sensations and ideas. The ideational components most closely related to the ego are the common sensations and the idea of one's own body.

That part of the affective and ideational contents which detaches itself from the totality of consciousness and fuses with the feeling of the ego, is called *self-consciousness*. It is no more a reality, apart from the processes of which it is made up, than is consciousness in general. It is merely a name for the interconnection of these processes, which furthermore, especially in their ideational components, can never be sharply distinguished from the rest of consciousness. This shows itself most of all in the facts that the idea of one's own body sometimes fuses with the feeling of the ego, sometimes is distinct from this feeling as an idea of an object, and that in general self-consciousness in its development always tends to reduce itself to its affective basis.

Further devel of discrim between subj & obj

12. This separation of self-consciousness from the other contents of consciousness also gives rise to the discrimination of *subject* and *objects*. The concept *subject* has, accordingly, as a result of its psychological development *three* different meanings of different scope, each of which may at different times be the one employed. In its narrowest sense the subject is the interconnection of volitional processes, which interconnection finds expression in the feeling of the ego. In the next wider sense it includes the real content of these volitional processes together with the feelings and emotions that prepare their way. Finally, in its widest significance it embraces the constant ideational substratum of these subjective processes, that is, the body of the individual as the seat of the common sensations. In the line of development the widest significance is the oldest, and in actual psychical experience the narrowest is continually giving way to a return to one of the others, because the narrowest form can be fully attained only through conceptual abstraction. This highest form is, then, in reality merely a kind of limit towards which self-consciousness may approach more or less closely.

Self

Self +

12 a. This discrimination of subject and objects, or of the *ego* and the *outer world* as it is commonly expressed by reducing the first concept to its original affective substratum and gathering the second together in a general concept — this discrimination is the basis of all the considerations responsible for the dualism which first gained currency in the popular view of things and was then carried over into philosophical systems. It is on this ground that psychology comes to be set over against the other sciences, in particular the natural sciences, as a science of the *subject* (§ 1, p. 4). Such a view could be correct only under the conditions that the discrimination of the ego from the outer world were a fact preceding all experience and that the concepts subject and objects could be unequivocally distinguished

once for all. But neither of these conditions is fulfilled. Self-consciousness depends on a whole series of psychical processes of which it is the product, not the producer. Subject and object are, therefore, neither originally, nor in later development, absolutely different contents of experience. They are concepts which are due to reflection and they result from the interrelations of the various components of the absolutely unitary content of our immediate experience.

References. Staude, Der Begriff der Apperception in der neueren Psychologie, Philos. Studien, vol. 1. Külpe, Die Lehre vom Willen in der neueren Psychologie, Philos. Studien, vol. 5. Wundt, Grundzüge der phys. Psych., chapters 16 § 5, and 22 § 1. Lectures on Hum. and Anim. Psych., lecture 17.

Transition [the Various Psychical Processes of [illegible]

13. The interconnection of psychical processes which makes up consciousness, has its deepest spring in the *processes of combination* which are continually taking place between the elements of the single contents of experience. Such processes are operative in the formation of single psychical compounds and they are what give rise to the simultaneous unity of the state of consciousness present at a given moment and also to the continuity of successive states. These processes of combination are of the most various kinds; each one has its individual coloring, which is never exactly reproduced in any second case. Still, the most general differences are those exhibited by attention, in the passive reception of impressions and the active apperception of impressions. As short names for these differences we use the term *association* to indicate a process of combination in a passive state of attention, and the terms *apperceptive combination* to indicate a combination in which the attention is active.

§ 16. ASSOCIATIONS.

1. The concept association has undergone, in the modern development of psychology, a necessary and very radical change in meaning. To be sure, this change has not been accepted everywhere, and the original meaning is still retained, especially by those psychologists who support, even to-day, the fundamental positions on which the association-psychology grew up (§ 2, p. 13 sq.). Association-psychology which is predominantly intellectualistic, pays attention to nothing but the *ideational contents* of consciousness and, accordingly, limits the concept of association to the combinations of ideas. **Hartley** and **Hume**, the two founders of association-psychology, spoke of "association of ideas" in this limited sense[1]). Ideas were regarded as objects, or at least as processes that could be repeated in consciousness with exactly the same character as that in which they were present at first (p. 14, 8). This led to the view that association was a principle for the explanation of the so-called "reproduction" of ideas. Furthermore, it was not considered necessary to account for the rise of composite ideas through psychological analysis, since it was assumed that the physical union of impressions in sense perception was sufficient to explain their psychological combination, and so the concept of association was limited to those forms of reproduction in which the associated ideas succeed one another in time. For the discrimination of the chief forms of successive associations, **Aristotle**'s logical scheme for the memory processes was accepted, and in accordance with the principle of classification by opposites the following forms were discriminated: association

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[1) The author remarks that the English word idea as here used corresponds to the German *Vorstellung*. Tr.]

by similarity and contrast, and association by simultaneity and succession. These class-concepts gained by a logical dichotomic process were dignified with the name "laws of associations". Modern associationism has generally sought to reduce the number of these laws. Contrast is regarded as a special form of similarity, for only those contrasted concepts are associated which belong to the same general class; and associations by simultaneity and succession are both included under contiguity. *Contiguity* is then regarded as *outer* association and contrasted with *inner* association by *similarity*. Some psychologists believe it possible to reduce these two forms to a single, still more fundamental, "law of association" by making association by contiguity a special form of similarity, or, what is still more common, by explaining similarity as a result of association by contiguity. In both cases association is generally brought under the more general principle of practice or habituation. The ordinarily so called association compl

prod
feeling
associa
Proces

2. The whole foundation for this kind of theorizing is destroyed by *two* facts which force themselves irresistibly upon us as soon as we begin to study the matter experimentally. The *first* of these facts is the general result of the psychological analysis of sense perceptions, namely, the fact that composite ideas, which association-psychology regards as irreducible psychical units, are in fact the results of synthetic processes which are obviously closely related to the complex processes commonly called associations. The *second* fact comes from the experimental investigation of memory processes. It is found that the *reproduction* of an idea in the strict sense of a renewal in its unchanged form of an earlier idea, never takes place at all. What really does happen in an act of memory is the rise of a new idea in conciousness; this new idea always differs from the earlier idea to which

it is referred, and usually derives its elements from a number of preceding ideas.

It follows from the first fact that there are elementary processes of association which unite the components of ideas and are earlier in their appearance than the associations of composite ideas with one another, although it is this later group of processes to which the name associations is generally limited. The second fact proves that ordinary associations can be nothing but complex products of the earlier elementary associations. These conclusions show the utter lack of justification for the exclusion from the concept association of the elementary processes the products of which are simultaneous ideas rather than successive ideas. Then, too, there is no reason for limiting the concept even to ideational processes. The existence of composite feelings, emotions, etc., shows, on the contrary, that affective elements also enter into regular combinations, which may in turn unite with associations of sensational elements to form complex products, as we saw in the rise of *temporal ideas* (§ 11, p. 156 sq.).

3. It follows from what has been said that the concept of association can gain a fixed, and in any particular case unequivocal, significance, only when association is regarded as in itself an *elementary process* which never appears in actual psychical processes except in a more or less complex form, so that the only way to find out the character of elementary association is to subject complex associated products to a psychological analysis. The ordinarily so-called associations (the successive associations) are only one, and the loosest at that, of all the forms of combination. In contrast with these we have the closer combinations from which the different kinds of *psychical compounds* arise. For these processes we have already adopted the general name *fusions*, because of the closeness of the union (p. 103 sq.). The next

stage of combination is found in the *simultaneous* associations which arise when a given psychical compound is changed through the influence of the elements of other compounds acting upon it. We designate these processes, because of the way in which the elements interact, *assimilations.* In addition to these assimilations we have another group of associations which are also generally simultaneous in character, namely, the processes which HERBART called *complications*, and which consist in *simultaneous associations of psychical compounds derived from different spheres of sensation.* Finally, there are associations which unite psychical compounds into temporal successions of ideas. These are the forms of association which are most easily observed. They were therefore, the only forms recognized at first. We call these *successive associations.*

A. FUSIONS.

Gen. Character

4. The various forms of fusion of psychical elements which are possible, have been described in detail in the course of the discussion of psychical compounds. These compounds are, indeed, nothing more nor less than the products of such fusions. The various fusion processes require, therefore, at this point only a brief treatment with special reference to the definition of their relation to the other processes of association. With reference then, to their special characteristics as association processes, the processes of fusion may be described as *thoroughly fixed associations of psychical elements.* An element of a fusion may, to be sure, appear in other combinations, but it can never appear alone. It is the processes of fusion, then, through which all the real psychical compounds of our conscious experience arise, for there are no isolated elements in consciousness (p. 32). The existence of these simplest forms of association could have

been inferred from the existence of more complex associations, even if there had been no direct evidence of the simple associations in the analysis of the various forms of psychical compounds. For it would hardly be comprehensible that combinations should arise between complex compounds if there were no tendency towards these combinations in the elements. Indeed, it will appear as a fact in the later discussions, that the associations of complex compounds are always to be traced back to associations between the elements of these compounds (p. 256).

5. We may distinguish as the *chief forms of psychical fusion*, *intensive fusion* and *extensive fusion*. This agrees with the results of our earlier discussions of psychical compounds. The *intensive fusions* subdivide into *sensation fusions* and *affective fusions*. The chief examples of sensation fusions are those which appear in clang compounds (p. 105), and the chief examples of affective fusions are composite feelings (p. 175). If we neglect for the moment those differences between various forms of intensive fusion which result from the nature and relations of the specific elements which in each case enter into the fusions, there are *two* distinguishing characteristics common to all intensive fusions. In the first place, such fusions result from the combination of sensational components, or affective components belonging to a single system. For example, the elements of a clang fusion belong to the sphere of tone sensations, the elements of a common feeling belong to the sphere of touch. In the second place, in every intensive fusion one element of the combination stands out as the *predominant factor*. For example, in a clang there is a chief tone, in a total feeling there is a chief feeling. *Extensive fusions* include spacial and temporal ideas, emotions and volitional processes. They are more complex than the intensive fusions because they

always include *combinations of disparate elements.* But even here there are certain *predominating* elements which give to the fusion products their unitary character. As predominating elements in the case of spacial ideas, we find outer tactual sensations and visual sensations. In the case of temporal ideas the feelings of tension and relief are such predominating factors. In the case of emotions and volitions the predominating factors are the partial feelings which result from the above mentioned feelings of tension and relief, and from feelings of excitation and depression (p. 171, 203). In point of complexity the various extensive fusions may be arranged in a series beginning with the least complex. The first members of such a series are the spacial ideas which are pure sensational ideas. They are, as compared with the other extensive fusions, relatively simple, while they are, as compared with intensive compounds, more complicated in character. Following the spacial ideas in the series, come temporal ideas. These contain both sensational and affective elements, but certain sensations are so closely fused with the dominating feelings that even the feelings are more or less ideational in character, that is, are directly referred to sensory impressions. The last members of the series are the emotional and volitional processes. These processes differ only in their closing phase, and all belong, therefore, to a single form. They constitute the transitional stage between fusions and complex associations, because in them, complex compounds, such as spacial and temporal ideas and compound feelings, all enter as accessories to the main process. The extensive fusions, including the spacial ideas as their simplest form, and volitional processes as their most complex form, may be said to have the same characteristics in regard to the kinds of elements which they contain as have complications. They also show certain of the essential characteristics of *successive* associations. In this way it may be said that there are in the various forms of fusions, anticipations of each of the complex forms of association which are to be described. Assimilations are anticipated in intensive fusions; complications are anticipated in extensive spacial fusions; and, finally, successive associations are anticipated in temporal fusions and in emotional and volitional processes, which appear as the more highly developed complications arising from temporal ideas. Intensive fusions and spacial fusions may also be classified, together with assimilations and complications, as simultaneous processes. Temporal ideas, emotions and volitions belong, together with the memory processes to be described later and the related processes, under the general head of *successive* associations.

B. ASSIMILATIONS.

6. *Assimilations* are forms of association which constantly appear during the formation of intensive ideas and spacial ideas and thus serve to supplement the process of fusion. Assimilation is most clearly demonstrable when certain single components of the product of an assimilation are given through external sense impressions, while others belong to earlier ideas. In such a case the assimilation may be demonstrated by the fact that certain components of the idea which are wanting in the objective impression or are there represented by components other than those actually present in the idea itself, can be shown to arise from earlier ideas. Experience shows that of these reproduced components, those are most favored which are very frequently present. Certain single elements of the impression are, however, after the analogy of the dominating elements in fusion, usually of more importance in determining the association than are the

others, so that when these dominating elements are altered, as may be the case especially with assimilations of the visual sense, the product of the assimilation undergoes a corresponding change. auditory assim

7. Among intensive compounds it is the *auditory ideas* which are most frequently the results of assimilation. They also furnish the most striking examples of the influence on present processes of earlier combinations which have become familiar through repetition. Of all the auditory ideas, the most familiar are the readily available *ideas of words*, for these usually receive more attention than other sound impressions. As a result the hearing of words is continually accompanied by assimilations; the sound impression is incomplete, but it is entirely filled out by earlier impressions, so that we do not notice the incompleteness. So it comes that not the correct hearing of words, but the *misunderstanding* of them, that is, the erroneous filling out of incomplete impressions through incorrect assimilations, is what generally leads us to notice the process. We may find an expression of the same fact in the ease with which any sound whatever, as, for example, the cry of an animal, the noise of water, wind, machinery, etc., can be made to sound like words almost at will. assimilation in sphere of

8. In the case of *intensive feelings* we note the presence of assimilations in the fact that impressions which are accompanied by sense-feelings and elementary aesthetic feelings, very often exercise a second direct affective influence for which we can account only when we recall certain ideas of which we are reminded by the impressions. In such cases the association is usually at first only a form of affective association, and only so long as this is true is the assimilation simultaneous. The related ideational association which explains the effect is, on the contrary, usually a later process

which must be classified as a form of successive association. For this reason it is often hardly possible, when we have clang impressions or color impressions accompanied by particular feelings, or when we have simple spacial ideas, to decide what is the immediate affective influence of the impression itself, and what is the influence of the association. As a rule, in such cases the affective process is to be looked upon as the resultant of an immediate factor and an associative factor which unite to form a single, unitary total feeling in accordance with the general laws of affective fusion (p. 175). Spacial assimilation of touch + vision

9. Association in the case of *spacial* ideas is of the most comprehensive character. It is somewhat less noticeable in the sphere of *touch* when vision is present, on account of the small importance of tactual ideas in general and especially on account of the small importance of touch for memory. For the blind, on the other hand, touch is the essential means of rapid orientation in space, as for example, in the rapid reading of the blind-alphabet. The effects of assimilation are most strikingly evident when several tactual surfaces are concerned, because in such cases assimilation is easily betrayed by the illusions which may arise in consequence of some disturbance in the usual interrelation of the sensations. Thus, for example, when we touch a small ball with the index and middle fingers crossed, we have the idea of *two* balls. The explanation is obvious. In the ordinary position of the fingers the external impression here given actually corresponds to two balls, and the many perceptions of this kind which have been perceived before, exercise an assimilative action on the new impression.

In *visual sense perceptions*, assimilative processes play a large part. They aid especially in the formation of ideas of the magnitude, of the distance, and of the three-dimensional character of visual objects. In this last respect they are essential supplements of immediate binocular motives for projection into depth. Thus, the correlation that exists between the ideas of the distance and ideas of magnitude of objects, as, for example, the apparent difference in the size of the sun or moon on the horizon and at the zenith, is to be explained as an effect of assimilation. The perspective of drawing and painting also depends on these influences. A picture drawn or painted on a plane surface can appear three-dimensional only on condition that the impression arouses elements of earlier percepts which are assimilated with the new impression. This is most evident in the case of unshaded drawings that can be seen either in relief or in intaglio. Observation shows that these differences in appearance are by no means accidental or dependent on the so-called "power of imagination", but that there are always elements in the immediate impression which determine definitely the assimilative process. The elements that are thus operative are, above all, the sensations arising from the position and movements of the eye. Thus, for example, a linear design of a prism which is looked at with one eye only so as to eliminate the binocular data for the perception of depth, will be seen alternately in relief and in intaglio according as we fixate in the two cases the parts of the drawing which correspond ordinarily to a solid or to a hollow object. A solid angle represented by three lines in the same plane appears in relief when the fixation-point is moved along one of the lines, starting from the apex; it appears in intaglio when the movement is in the opposite direction, that is from the end of the line towards the apex. In these and all like cases the assimilation is determined by the rule that in its movement over the fixation-lines of objects the eye usually passes from nearer to more distant points, and when it fixates any point for a longer period of fixation, it generally turns toward those parts of the object which lie near at hand. Effects of assimilation are also noticeable in cases of misreading of words. These facts of misreading correspond fully with the facts of incorrect hearing described above (p. 252). In reading we overlook the misprints in a book. This is due, not so much to the fact that we have failed to notice the wrong letter which was present, as to the fact that we have substituted the right letters for the wrong one[1]).

In other cases the *geometrical optical illusions* § 10 (19 and 20) which are due to the laws of ocular movements, produce as secondary effects certain ideas of depth which eliminate the contradictions between the retinal images which result from these figures, and the illusions of length and directions which arise from the perceptions of the impressions. Thus, to illustrate, an interrupted straight line appears longer than an equal uninterrupted line (p. 137); as a result we tend to project the first to a greater depth than the latter. Here both lines cover just the same distances on the retina in spite of the fact that because of the different motor energy connected with their estimation their lengths are perceived as different. An elimination of the contradiction which thus arises is effected by the formation of different ideas of distance, for when one of two lines the retinal images of which are alike appears longer than the other, this longer line must, under the ordinary conditions of vision, belong to a more distant object. Again, to take another illustration, when one straight line is intersected at an acute angle by another line, the result is an overestimation of the acute

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1) Assimilation processes which take place during reading may be studied most advantageously by means of the tachistoscope mentioned on page 231. This apparatus allows the words to be seen only for a short interval.

angle, which overestimation sometimes gives rise, when the line is long, to an apparent bending of the line near the point of intersection (p. 137). Here too the contradiction between the true course of the line and the increase in the angle of intersection, is eliminated by the apparent projection of the line into the third dimension. In all these cases the perspective can be explained only as the assimilative effect of the elements of earlier ideas.

Psyol. analysis
ynthesis
Process

10. In none of the assimilations discussed is it possible to show that any former idea has acted as a whole on the new impression. Generally such action of a whole idea is impossible because we must attribute the assimilative influence to a large number of ideas, differing in many respects from one another. Thus, for example, a straight line which intersects a vertical at an acute angle, corresponds to innumerable cases in which an inclination of the line with its accompanying increase of the angle appeared as a component of a three-dimensional idea. But all these cases may have been very different in regard to the size of the angle, the length of the lines, and other attending circumstances. We must, accordingly, think of the assimilative process as a process in which not a single definite idea is operative, nor even a definite combination of elements from earlier ideas, but rather, as a rule, we must think of it as a process in which a great number of such combinations are operative. These many antecedents need agree only approximately with the new impression in order to affect consciousness.

We may gain some notion of the way in which this effect is produced from the important part that certain elements connected with the impression play in the production of the process, as, for example, the inner tactual sensations in visual ideas. Obviously it is these immediate sensational elements which serve to pick out from the great mass of ideational elements reacting on the impression, certain particular elements which correspond to themselves. The present sensations then bring these selected factors into a form agreeing with the form of the rest of the components of the immediate impression. At the same time it appears that not merely are the elements of our memory images relatively indefinite and therefore variable, but that even the perception of an immediate impression may, under special conditions, vary within fairly wide limits. In this way the assimilative process starts primarily from elements of the immediate impression, chiefly from such as are of preeminent importance for the formation of the idea, as, for example, in visual ideas, the sensations of ocular position and movement. These elements call up certain particular memory elements corresponding to themselves. These memories then exercise an assimilative effect on the immediate impression, and the impression in turn reacts in the same way on the reproduced elements. These separate acts are, like the whole process, not successive, but, at least for our consciousness, simultaneous. For this reason the product of the assimilation is apperceived as an immediate, unitary idea. The two distinguishing characteristics of assimilation are, accordingly, 1) that it is made up of a series of *elementary* processes of combination, that is, processes that have to do with the components of ideas, not with the whole ideas themselves, and 2) that the united components modify one another through *reciprocal assimilations.*

Differences among these processes

11. On this basis we can explain without difficulty the main differences between complex assimilative processes, by the very different parts that the various factors necessary to such processes play in the various concrete cases. In ordinary sense perceptions the direct elements are so predominant that the reproduced elements are as a rule entirely

overlooked, although in reality they are never absent and are often very important for the perception of the objects. These reproduced elements are much more noticeable when the assimilative effect of the direct elements is hindered through external or internal influences, such as indistinctness of the impressions or affective and emotional excitement. In all cases where the difference between the impression and the idea becomes, in this way, so great that it is apparent at once on closer examination, we call the product of the assimilation an *illusion*.

The universality of assimilation makes it certain that such processes occur also between reproduced elements, in such a way that any memory idea which arises in the mind is immediately modified by its interaction with other memory elements. Still, in such cases we have, of course, no means of demonstration. All that can be established as probable is that even in the case of so-called "pure memory processes", direct elements in the form of sensations and sense-feelings aroused by peripheral stimuli, are never entirely absent. In reproduced visual images, for example, such elements are present in the form of inner tactual sensations of the eye.

attributes ? Chief forces

C. COMPLICATIONS.

12. *Complications*, or the combinations between unlike psychical compounds, are no less regular components of consciousness than are assimilations. Just as there is hardly an intensive or extensive idea or composite feeling which is not modified in some way through the processes of reciprocal assimilation between direct and reproduced elements, so almost every one of these compounds is at the same time connected with other, dissimilar compounds, with which it has some constant relations. In all cases, however, complications are

different from assimilations in the fact that the unlikeness of the compounds makes the connection looser, however regular it may be, so that when one component is direct and the other reproduced, the latter can be readily distinguished at once. There is, however, another reason which makes the product of a complication appear unitary in spite of the easily recognized difference between its components. This is the *predominance* of *one* of the compounds, which pushes the other components into the obscurer field of consciousness.

If the complication unites a direct impression with memory elements of disparate character, the direct impression with its assimilations is regularly the predominant component, while the reproduced elements sometimes have an influence noticeable only through their affective tone. Thus, when we *speak*, the auditory word ideas are the predominant components, and in addition we have as obscure factors, direct motor sensations and reproductions of the visual images of the words. In *reading*, on the other hand, the visual images come to the front while the others become weaker. In general it may be said that the existence of a complication is frequently noticeable only through the peculiar coloring of the total feeling which accompanies the predominant idea. This is due to the power of obscure ideas to have a relatively intense effect through their affective tones on the attention (p. 237). Thus, for example, the characteristic impression of a rough surface, a dagger-point, or a gun, arises from a complication of visual and tactual impressions, and in the last case, of auditory impressions as well; but as a rule such complications are noticeable only through the feelings they excite.

Interconnection with assimilation

D. SUCCESSIVE ASSOCIATIONS.

13. Successive association is by no means a process that differs essentially from the two forms of simultaneous association, assimilation and complication. It is, on the contrary, due to the same general causes as these, and differs only in the secondary characteristic that the process of combination, which in the former cases consisted, so far as immediate introspection was concerned, of a single instantaneous act, is here protracted and may therefore be readily divided into *two* acts. The first of these acts corresponds to the appearance of the *reproducing* elements, the second to the appearance of the *reproduced* elements. Here too, the first act is often introduced by an external sense impression, which is as a rule immediately united with an assimilation. Other reproduced elements which might enter into an assimilation or complication are held back through some inhibitory influence or other — as, for example, through other assimilations that force themselves earlier on apperception — and do not begin to exercise an influence until later. In this way we have a second act of apperception clearly distinct from the first, and differing from it in psychical content. The difference is the more essential, the more numerous the new elements which are added through the retarded assimilation and complication, and the more these new elements displace the earlier elements because of their differences in character. Gen. Char. of Succes. associations

14. In the great majority of cases the association thus formed is limited to *two* successive ideational or affective processes which are connected, in the manner described, through assimilations or complications. New sense impressions or some apperceptive combinations (§ 17) may then connect themselves with the second member of the associa-

tion. Less frequently it happens that the same processes which led to the first division of an assimilation or complication into a successive process, may be repeated with the second or even with the third member, so that in this way we have an *associational series*. Generally, however, such a series is formed only under exceptional conditions. Such conditions arise when the normal course of apperception has been disturbed, as for example, in the so-called "flight of ideas" of the insane. In normal cases and under the ordinary conditions of life, serial associations hardly ever appear.

Serial

14 a. Such serial associations may be produced most easily under the artificial conditions of experimentation, when the effort is purposely made to suppress new sense impressions and apperceptive combinations. But the process resulting in such cases differs from that described above in that the successive members of the series do not connect, each with its immediate predecessor, but all go back to the first, until a new sense impression or an idea with an especially strong affective tone furnishes a new starting point for the succeeding associations. The associations in the "flight of ideas" of the insane generally show the same typical tendency to return to certain predominant centres.

attributes and differences) these Process

a. *Sensible Recognition and Cognition.*

15. The cases in which the ordinary form of association which is made up of two partial processes, may be most clearly observed arising out of simultaneous assimilations and complications, are the cases designated by the special names, sensible recognition and cognition. The qualification "sensible" is added when referring to these associative processes, to indicate, on the one hand, that the first member of the process is always a sense impression, and, on the other, to distinguish these associations from the *logical* processes of cognition.

The case of recognition which from the psychological point of view is the simplest, is that in which an object has been perceived only *once* and is recognized as the same when met a second time. If this second perception follows very soon after the first, or if the first was especially emphatic and exciting, the association usually takes place immediately, as a simultaneous assimilation. This process differs from other assimilations, which take place in connection with every sense perception, only in the characteristic accompanying feeling, the *feeling of familiarity.* Such a feeling is never present except when there is some degree of "consciousness" that the given impression has been received before. It is, therefore, evidently one of those feelings which comes from the ideas obscurely present in consciousness. The psychological difference between this and an ordinary simultaneous assimilation must be looked for in the fact that at the moment when, in the apperception of the impression, the assimilation takes place, there arise in the obscure regions of consciousness some components of the original idea which do not enter into the assimilation. The relation of these obscure components to the elements of the idea which is apperceived, finds expression in the feeling of familiarity. The unassimilated components may be elements of an earlier impression which were so different from certain elements of the new, that they could not be assimilated, or, and this is usually the case, they may be complications that were clear before, but now remain unobserved. This influence of complication explains how it is that the name of a visual object, for example, the proper names of persons, and often other auditory qualities, such as the tone of voice, are very great helps in recognition. To serve as such helps, however, they need not necessarily be clear ideas in consciousness. When we have heard a man's name, the recognition of the man the next time we meet him may be aided by the name without our calling it clearly to mind.

Passage from Simultaneo to Successiv process

16. The observations described show what are the conditions under which a recognition may pass from a simultaneous into a successive association. If a certain interval elapses before the elements of the earlier idea which gradually rise in consciousness, can produce a distinct feeling of familiarity, the whole process divides into *two* acts: into the act of *perception* and the act of *recognition*. Perception depends on the ordinary simultaneous assimilations only, while in recognition the obscure, unassimilated elements of the earlier idea show their influence. The line of division between these partial processes is, accordingly, more distinct the greater the difference between the earlier impressions and the new one. In a case of marked difference not only is there usually a long period of noticeable inhibition between perception and recognition, but certain additional apperceptive processes, namely, the processes of voluntary attention which take part in the act of recollection, also come to the aid of the association. As a special form of this kind of process we have the phenomenon called "mediate recognition". This consists in the recognition of an object, not through its own attributes, but through some accompanying mark, which stands in a chance connection with it, as, for example, when a person is recognized because of his companion. Between such a case and a case of immediate recognition there is no essential psychological difference. For even those characteristics that do not belong to the recognized object in itself, still belong to the whole complex of ideational elements that help in the preparation and final carrying out of the association. And yet, as we should naturally expect, the retardation which divides the whole recognition into two ideational processes, and often leads to the cooperation of voluntary

recollection, generally appears in its most evident form in mediate recognitions. Difference between processes + recogniti & cogniti

17. This simple process of recognition which takes place when we meet again an object that has been perceived once before, is a starting point for the development of various other associative processes, for processes which like recognition stand on the boundary between simultaneous and successive associations, and for processes in which there is a more marked degree of that retardation in the formation of associations and complications which leads to a successive rather than simultaneous occurrence of the processes. Thus, the recognition of an object that has often been perceived is easier and, therefore, as a rule an instantaneous process. It is also more like the ordinary assimilation because the feeling of familiarity is much less intense. *Sensible cognition* differs generally but little from the recognition of single familiar objects. The logical distinction between the two concepts consists in the fact that recognition means the establishment of the individual identity of the newly perceived object with a formerly perceived object, while cognition is the subsumption of an object under a familiar concept. Still, there is no real logical subsumption in a process of sensible cognition any more than there is a fully developed class-concept under which the subsumption could be made. The psychological equivalent of such a subsumption is to be found in this case in the mere process of associating the impression in question with an indefinitely large number of objects. This presupposes an earlier perception of various objects which agree only in certain particular properties, so that the process of cognition approaches more nearly to the ordinary assimilation in its psychological character, the more familiar the class to which the perceived object belongs, and the more the object agrees with the most common objects

of this class. In equal measure the feelings peculiar to the processes of cognition and recognition decrease and finally disappear entirely, so that when we meet very familiar objects we do not speak of a cognition at all. The process of cognition is noticeable only when the assimilation is *hindered* in some way, either because the perception of the class of objects in question has become uncommon or because the single object shows some unique characteristics. In such a case the simultaneous association may become successive by the separation of perception and cognition into two successive processes. Just in proportion as this happens, we have a specific *feeling of cognition* which is indeed related to the feeling of familiarity, but, as a result of the different conditions for the rise of the two, differs from the feeling of familiarity especially in its temporal course.

Rise out of process of recognition

b. *Memory processes.*

18. There is another direction, essentially different from that just described, along which the process of recognition may develop. This shows itself when the hindrances to immediate assimilation which give rise to the transition from simultaneous to successive associations, are so great that the ideational elements which do not agree with the new perception, unite — either after the recognition has taken place or even when there is no such recognition whatever — to form a special idea referred directly to an earlier impression. The process that arises under such circumstances is a *memory process* and the idea that is perceived is a *memory idea*, or *memory image.*

Interconnection + gen. significe. of memory process

18a. Memory processes were the ones to which association psychology generally limited the application of the concept association. But, as has been shown, these are associations that take place under especially complicated conditions. The erroneous view of association psychology rendered an understanding of the genesis of an association impossible from the first, and it is easy to see that the doctrine accepted by the associationists is limited essentially to a logical rather than a psychological classification of the association products which are to be observed in memory processes. An insight into the character of the more complex processes is possible, however, only through a study starting with the simpler associative processes, for the ordinary simultaneous assimilations and simultaneous and successive recognitions present themselves very naturally as the antecedents of memory associations. But even simultaneous recognition itself is nothing but an assimilation accompanied by a feeling which comes from the unassimilated ideational elements obscurely present in consciousness. In the second process these unassimilated elements serve to retard the process, so that the recognition develops into the primitive form of successive association. The impression is at first assimilated in the ordinary way, and then again in a second act with an accompanying feeling of recognition which feeling serves to indicate the greater influence of certain reproduced elements. In this simple form of successive association the two successive ideas are referred to one and the same object, the only difference being that each time some different ideational and affective elements are apperceived. With *memory associations* the case is essentially different. Here the elements of the earlier impressions which are different from those in the present impression predominate, and the first assimilation of the impression is followed by the formation of an additional idea. This idea is made up of elements of the present impression and of elements belonging to certain earlier impressions, which earlier impressions are suitable for the assimilation because of certain of their components. The more the elements of the earlier impression which differ from the elements of the present impression, predominate, the more the second idea differs from the first, or, on the other hand, the more the like elements predominate, the more the two ideas will be *alike*. In any case the second idea is always a *reproduced* idea and distinct from the new impression as an independent compound.

Stages of a memory process

19. The general conditions for the rise of memory images may also exhibit shades and differences which correspond to the differences which appear in the processes of recognition and cognition (15, 17). Thus the recognition of an object perceived *once* and the recognition of an object familiar through *frequent* perceptions, and finally, the cognition of an object that is *familiar* in its general class-characteristics may all become sources of various modifications in memory processes.

Mixed forms between recognition an
rememb

Simple recognition becomes a memory process when the immediate assimilation of the impression is hindered by elements that belong, not to the object itself, but to circumstances that attended its earlier perception. Just because the former perception occurred only once, or at least only once so far as the reproduction is concerned, these accompanying elements may be relatively clear and distinct and sharply distinguished from the surroundings of the new impression. In this way we have transitional forms between recognition and remembering: the object is recognized, and at the same time referred to a particular earlier sense perception the accompanying circumstances of which add a definite spacial and temporal relation to the memory image. The memory process is especially predominant in those cases in which the elements of the new impression that gave rise to the assimilation are entirely suppressed by the other components of the image, so that the associative relation between the memory idea and the impression may remain entirely unnoticed.

19a. Such cases have been spoken of as "mediate memories", or "mediate associations". Still, just as in the case of "mediate recognitions", so here, we are dealing with processes that are fundamentally the same as ordinary associations. Take, for example, the case of a person who, sitting in his room at evening, suddenly remembers without any apparent reason a landscape that he passed through many years before; examination shows that there happened to be in the room a fragrant flower which he saw for the first time in that landscape. The difference between this and an ordinary memory process in which the connection of the new impression with an earlier experience is clearly recognized, obviously consists in the fact that here the elements which recall the idea are pushed into the obscure background of consciousness by other ideational elements. The not infrequent experience, commonly known as the "spontaneous rise" of ideas, in which a memory image suddenly appears in our mind without any assignable cause, is in all probability reducible in every case to such latent associations.

Memory process based on repeated recognition

& cogniti

20. Memory processes that develop from recognitions which have been *often* repeated and from *cognitions*, are, in consequence of the greater complexity of their conditions, different from those connected with the recognition of objects perceived but once. When we perceive an object that is familiar either in its own individual characteristics or in the characteristics of its class, the range of possible associations is incomparably greater, and the way in which the memory processes shall arise from a particular impression depends less on the single experiences which give rise to the association, than it does on the general disposition and momentary mood of consciousness, and also on the interference of certain active apperceptive processes and on the intellectual feelings and emotions which are connected with these processes. *Word ideas* are important aids to association. These ideas are in many cases connected with individual objects (proper names), but they are especially important when they refer to class characteristics of ideas (class names). With conditions which are so varied, it is easy to see that as a general thing it is impossible to calculate beforehand what the association in any given case will be. As soon as the act of memory is ended, however, the traces of its associative origin seldom

escape careful examination, so that we are justified in regarding association as the universal and only cause of memory processes under all circumstances.

In thus deriving memory from association, it is never to be forgotten that every concrete memory process is by no means a *simple process*, but is made up of a large number of *elementary processes*, as is apparent from the fact that every such process is produced by a psychological development of its simple antecedents, namely, the simultaneous assimilations. The most important of these elementary processes is the assimilative interaction between some external impression and the elements of an earlier psychical compound, or between a memory image already present and such elements. Connected with this there are two other processes which are characteristic of memory processes: one is the hindrance of the assimilation by unlike elements, the other is to be found in the assimilations and complications connected with these elements and giving rise to a psychical compound which differs from the first impression and is referred more or less definitely to some previous experience, especially through its complications. This reference to the earlier experience shows itself through a characteristic feeling, the *feeling of remembering*, which is related to the feeling of familiarity, but is in its temporal genesis different, probably in consequence of the greater number of obscure complications that accompany the appearance of the memory image.

If we try to find the elementary processes to which both memory processes and all complex associations are reducible, we shall find two such processes: *combinations resulting from identity* and *combinations resulting from contiguity*. In general the first class is predominant when the process is more like an ordinary assimilation and recognition, while the second appears more prominently the more the processes approach mediate memory in character, that is, the more the processes take on the semblance of spontaneous ideas.

20a. It is obvious that the usual classification, which makes all memory processes associations by either similarity or contiguity, is entirely unsuitable if we attempt to apply it to the modes of psychological genesis that these processes manifest. On the other hand, it is too general and indefinite if we try to classify the processes logically according to their products, without reference to their genesis. In the latter case the various relations of subordination, superordination, and coordination, of cause and end, of temporal succession and existence, and the various kinds of spacial connection, find only inadequate expression in the very general concepts "similarity" and "contiguity". When, on the other hand, the manner of origin is studied, every memory process is found to be made up of elementary processes that may be called partly associations by similarity, partly associations by contiguity. The assimilations which serve to introduce the process and also those which serve to bring about the reference to a particular earlier experience at its close, may be called associations by similarity. But the term "similarity" is not exactly suitable even here, because it is *identical* elementary processes which give rise to the assimilation, and when an identity of elements does not exist, such identity is always produced by reciprocal assimilation. In fact, the concept of "association by similarity" is based on the presupposition that composite ideas are permanent psychical objects and that associations take place between these finished ideas. The concept of association by similarity must be rejected when once this presupposition is given up as entirely contradictory to psychical experience and fatal to a proper understanding of the same. When certain products of association, as, for example, two successive memory images, are similar, this likeness is always reducible to processes of assimilation made up of elementary combinations resulting from identity or contiguity. The association through identity may take place either between components that were originally the same, or between those that have gained this character through assimilation. Association by contiguity is the form of combination between those elements that hinder the assimilation, thus dividing the whole process into a succession of *two* processes, and also contributing to the memory image those components which give it the character of an independent compound, different from that of the impression which gave rise to it. The joint action of associations of identity and contiguity is also very obvious in the case of the simplest forms of memory association, namely, in those forms which are made up of simple sensory impressions. Indeed, it is only by means of this joint action of the two forms of association that we can give any natural explanation of the facts in question. Thus, when a yellow color impression calls up in the mind the similar color orange, the explanation offered by the pure theory of association by similarity is that the close similarity between the two colors produced the association. On the other hand, the pure theory of contiguity explains the same fact on the ground that the two impressions have been seen next to each other an indefinite number of times in the rainbow, in the spectrum, and in the shadings of painted surfaces. In reality the facts are not as stated in either of these explanations. It is true, rather, that colors, like tones, form a continuous sensation series within which the impressions standing nearest to each other are always most closely associated on account of the conditions of their natural rise and variation. There are always brought into consciousness with any given color impression, other associated colors, especially those that lie nearest to the given color. This is possible only because the present color calls up first the color which is identical with itself in some memory complex, and then calls up through this identical color the one next to it in the memory complex. Yellow, for example, can call up the yellow which has been seen before in the spectrum (association by identity) and then through this first process, may further call up the neighboring orange (association by contiguity). It is especially obvious in this case that there must be a combination of the two forms of association, because the two stages in the complete association are much more distinctly separate than in the case of complex ideas where the two stages unite at once into a single composite process.

Elements of Memory Processes.

21. All the results of memory associations, so far as they are related to earlier impressions, are commonly grouped together under the name *memory*. This concept memory originated in popular psychology and was then carried over into the now abandoned faculty psychology. Memory must, of course, in every particular case be subjected to a special analysis to show what are the elementary association processes involved in the special phenomena under consideration, and what are the particular effects of these association processes. Such analysis finds the simplest conditions for its application in those cases in which the memory associations take place between simple impressions, or at least between impressions which arise under relatively simple and uniform conditions. Thus, one may investigate the memory for tone sensations, or for simple visual objects, by measuring the accuracy of such memory in terms of the clearness with which an earlier impression is *recognized* after the lapse of a given interval. As a result of such measurements it appears that immediately after an impression is given, its reproduction is relatively accurate. Very soon (in the case of tones after even two seconds, in the case of simple visual objects after an interval somewhat, but not very much, longer) reproduction reaches its maximum of accuracy and then begins to decrease with gradually lessening rapidity until, finally, (after about 60 seconds) it reaches a point at which it remains approximately constant for a long time. In the course of this general decrease in accuracy of reproduction, there appear successive periods of fluctuating accuracy which probably are related to the fluctuations of attention already mentioned (p. 233). Of special interest for the investigation of the relation of intervals to memory processes are the facts of *time memory*. By time memory we mean the memory for temporal intervals. This form of memory can be investigated with the highest

degree of exactness, just as can the attributes of time ideas in general, by using so-called empty intervals marked off by auditory impressions. Through investigations of this sort it appears that the relation between the memory image of an interval and the objective length of this interval depends, in the first place, on the length of the interval in question; and, in the second place, on the amount of time that elapses between the giving of the impression and the formation of the memory image. The length of the given interval affects the process in accordance with the general rule, that *short intervals are overestimated in memory and long intervals are underestimated.* Between these two forms of false estimation lies an *indifference-interval* for which the remembered interval is, on the average, equal to the given interval. When the reproduction follows the impression very quickly this indifference-interval is 0.5—0.6 sec. If the interval is increased in length there appears here also a kind of periodic recurrence of exact estimations, for which the regular rule is, that all the multiples of the indifference-interval are more accurately estimated than are the intervals lying between these multiples. This periodic recurrence of exact estimations is probably due to the fact that longer intervals have to be broken up into groups of short intervals in order to be grasped in consciousness as single wholes. In such division and grouping the indifference-interval presents itself as the standard simple unit. The fact of periodic accuracy in estimation is also doubtless connected with the above described processes of involuntary rhythmical subdivision of long time intervals (p. 165). When the period between impression and reproduction is longer, the exactness of estimation suffers a general decrease, just as in the case of the reproduction of qualitative tone sensations and light sensations. It finally reaches a minimum at which it continues for a relatively long period of time at an approximately constant level. With a lengthening of the period between impression and reproduction the reproduced interval becomes more and more clearly shortened in comparison with the original interval. No very exact determinations have been made of these last described facts. They are, however, familiar from every-day experience.

22. The character of *memory ideas* is intimately connected with the complex nature of the memory processes. The description of these ideas as weaker, but otherwise faithful, copies of the direct sense perceptions is as far out of the way as it could possibly be. Memory images and sense perceptions differ, not only in quality and intensity, but most emphatically in their elementary composition. We may diminish the intensity of a sensible impression as much as we like, but so long as it is perceptible at all it is an essentially different compound from a memory idea. The *incompleteness* of the memory idea is much more characteristic than the small intensity of its elements. For example, when I remember an acquaintance, the images I have of his face and figure are not mere obscure reproductions of what I have in consciousness when I look directly at him, but most of the features do not exist at all in the reproduced ideas. Connected with the few ideational elements which are really present and which can be but little increased in number even when the attention is voluntarily concentrated upon the task, are certain factors added through contiguity and certain complications, such as the environments in which I saw my acquaintance, his name, and finally, and more especially, certain affective elements which were present at the meeting. These accompanying components are what make the image a memory image.

23. There are great differences in the effectiveness of

these accompanying elements and in the distinctness of the sensational elements of the memory image in the cases of different individuals. Some persons locate their memory images in space and time much more precisely than do others; the ability to remember colors and tones is also very markedly different. Very few persons seem to have distinct memories of odors and tastes; in place of these most of us have, as substitute complications, accompanying motor sensations of the nose and taste-organs.

These differences between different individuals are all referred to as differences in "memory". The concept memory is, thus, a supplementary concept which is very useful in giving clear expression to these individual differences in the memory processes. It must, however, never be forgotten that the term always refers to what is in reality a series of processes, and that in each particular case a special explanation of the facts is required. We speak of a faithful, comprehensive, and easy memory, or of a good spacial, temporal, and verbal memory, etc. These expressions serve to point out the different directions in which, according to the original disposition or habit of the person, the elementary assimilations and complications occur.

One important phenomenon among the various differences referred to, is the gradual *weakening of memory with old age.* The disturbances resulting from diseases of the brain agree in general with the results of this weakening of memory through age. Both are of special importance to psychology because they exhibit very clearly the influence of complications on memory processes. One of the most striking symptoms of failing memory, in both normal and pathological cases, is the weakening of *verbal memory.* It generally appears as a lack of ability to remember, first proper names, then names of concrete objects in the ordinary environment, still later abstract words, and finally, particles that are entirely abstract in character. This succession corresponds exactly to the possibility of substituting in consciousness for single classes of words other ideas that are regularly connected with them through complication. This possibility is obviously greatest for proper names, and least for abstract particles, which can be retained only through their verbal signs.

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§ 17. APPERCEPTIVE COMBINATIONS.

1. Associations in all their forms are regarded by us as *passive experiences*, because the feeling of activity, which is characteristic of all processes of volition and attention, never arises except as it is added to the already completed association process in a kind of apperception of the *resultant*,

given content (p. 238). Associations are, accordingly, processes that can arouse volitions but are not themselves directly influenced by volitions. This absence of any dependence on volition is, however, the criterion of a *passive* process.

The case is essentially different with the second kind of combinations which are formed between different psychical compounds and their elements, namely, the *apperceptive combinations*. Here the feeling of activity with its accompanying variable sensations of tension does not merely follow the combinations as an after-effect produced by them, but it precedes them so that the combinations themselves are *immediately recognized as formed with the aid of the attention*. In this sense these experiences are called *active* experiences.

Relation
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2. Apperceptive combinations include a large number of psychical processes that are distinguished in popular parlance under the general terms thinking, reflection, imagination, understanding. These are all regarded as psychical processes of a type higher than sense perceptions or pure memory processes, while at the same time they are all looked upon as different from one another. Especially is this true of the so-called functions of imagination and understanding. In contrast with this loose view of the faculty theory, association psychology sought to find a unitary principle by subsuming also the apperceptive combinations of ideas under the general concept of association, and at the same time limiting the concept, as noted above (p. 245), to successive association. This reduction to successive association was effected either by neglecting the essential subjective and objective distinguishing marks of apperceptive combinations, or by attempting to avoid the difficulties of an explanation, through the introduction of certain supplementary concepts taken from popular psychology. Thus, "interest" and

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"intelligence" were credited with an influence on associations. Very often this view was based on the erroneous notion that the recognition of certain distinguishing features in apperceptive combinations and associations meant the assertion of a fundamental division between the former and the latter. Of course, this is not true. All psychical processes are connected with associations as much as with the original sense perceptions. Yet, just as associations always form a part of every sense perception and in spite of that appear in memory processes as relatively independent processes, so apperceptive combinations are based always on associations, but the essential attributes of these apperceptive combinations are not traceable to associations. Gen. Classif.

3. In trying to account for the essential attributes of apperceptive combinations, we may divide the psychical processes that belong to this class into *simple* and *complex apperceptive functions*. The simple functions are those of *relating* and *comparing*, the complex those of *synthesis* and *analysis*.

A. SIMPLE APPERCEPTIVE FUNCTIONS.

(Relating and Comparing.)

Relating process

4. The most elementary apperceptive function is that of *relating two psychical contents to each other*. The grounds for such relating are always given in the single psychical compounds and their associations, but the actual *carrying out* of the process itself is a special apperceptive activity through which the *relation itself* becomes a special conscious content, distinct from the contents which are related, though indeed inseparably connected with them. For example, when we recognize the identity of an object with one perceived before, or when we are conscious of a definite relation between a remembered event and a present impression, there is in

both cases a relating apperceptive activity connected with the associations.

So long as the recognition remains a pure association, the process of relating is limited to the feeling of familiarity which follows the assimilation of the new impression either immediately, or after a short interval. When, on the contrary, apperception is added to association, this feeling is supplied with a clearly recognized ideational substratum. The earlier perception and the new impression are separated in time and then brought into a relation of agreement on the basis of their essential attributes. The case is similar when we become conscious of the motives of a memory act. This also presupposes that a comparison of the memory image with the impression which occasioned it, is added to the merely associative process which gave rise to the image. This, it will be seen, is a process that can be brought about only through active attention.

5. Thus, the *relating* function is brought into activity through associations, wherever these associations themselves or their products are made the objects of voluntary observation. The relating function is connected, as the examples mentioned show, with the function of *comparing*, whenever the related contents of consciousness are clearly separated processes, belonging to one and the same class of psychical experiences. Relating activity is, therefore, the wider concept, comparison is the narrower. A comparison is possible only when the compared contents are brought into relation with one another. On the other hand, conscious contents may be related without being compared with one another, as is the case, for example, when an object and the attributes of the object are related, or when one process is related to another which regularly follows or precedes it. As a result of this it follows that where the fuller conditions necessary for a

comparison are present, the experiences given may be merely related, or they may also be compared with each other. Thus, one calls it relating when he thinks of a present impression as the reason for remembering an earlier experience; he calls it comparing, on the other hand, when he establishes certain definite points of agreement or difference between the earlier and the present impression.

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6. *The process of comparing* is, in turn, made up of *two* elementary functions which are as a rule intimately interconnected. These two elementary functions are first, the *perception of agreements*, and second, the *perception of differences*. There is a mistaken view prevalent even in present-day psychology. It originated in popular psychology and was strengthened by the discussions of logical intellectualism. It consists in the acceptance of the notion that the mere existence of psychical elements and compounds is identical with their apperceptive comparison. Every sensation is accordingly treated as a "sensory judgment", every immediate perception of distance as a "judgment of depth", and so on through the whole series of processes. In all these cases, however, the judgment appears after the sensations and ideas; the judgment must, therefore, be recognized as a separate process. To be sure, agreements and differences arise in our psychical processes, if they did not we could not observe them. But the comparing activity through which these likenesses and differences in sensations and ideas are made evident, is not identical with the sensations and ideas themselves. It is a function that may arise in connection with these elements, but does not necessarily so arise.

[illegible]

7. Even the psychical elements, that is, sensations and simple feelings, can be compared with reference to their agreements and differences. Indeed, it is through a series of such comparisons that we arrange these psychical elements

into systems, each one of which contains the elements that are most closely related. Within a given system two kinds of comparison are possible, namely, comparison *in respect to quality* and comparison *in respect to intensity.* Then, too, a comparison between grades of *clearness* is possible when attention is paid to the way in which the elements appear in consciousness. In the same way comparison is applied to intensive and extensive psychical compounds. Every psychical element and every psychical compound, in so far as it is a member of a regular system, constitutes a *psychical magnitude.* A determination of the value of such a psychical magnitude is possible only through *comparison* with some other in the same system. Psychical magnitude is, accordingly, an original attribute of every psychical element and compound. It is of various kinds, as intensity, quality, extensive (spacial and temporal) value, and, when the different states of consciousness are considered, clearness. But the *determination of psychical value* can be effected only through the apperceptive function of comparison.

Dif. between Psychical & Physical Elem

8. *Psychical* measurement differs from *physical* measurement in the fact that the latter may be carried out in acts of comparison separated almost indefinitely in time, because its objects are relatively constant. For example, we can determine the height of a certain mountain to-day with a barometer and then after a long time we may determine the height of another mountain, and if no sensible changes in the configuration of the land have taken place in the interval, we can compare the results of our two measurements. Psychical compounds, on the other hand, are not relatively permanent objects, but continually changing processes, so that we can compare two such psychical magnitudes only when other conditions remain the same, and the two factors to be compared follow each other in immediate succession.

1st These requirements have as their immediate corollaries: first, that there is no absolute standard for the comparison of psychical magnitudes, but every such comparison stands by itself and is of merely *relative* validity; secondly, that finer 2nd comparisons are possible only between psychical magnitudes of the same dimension, so that a reduction, analogous to that by which the most widely separate physical quantities, such as periods of time and physical forces, are all expressed in terms of one dimension of space, is out of the question in psychical comparisons. Methods of Psychical Measure

Apply succession of agreement & differences

9. It follows that the possible relations between psychical magnitudes which can be established by direct comparison are limited in number. The establishment of such relations is possible only in certain *particularly favorable cases.* These favorable cases are 1) *the equality between two psychical magnitudes* and 2) *the just noticeable difference between two such magnitudes*, as, for example, two sensational intensities of like quality, or two qualities of like intensity belonging to the same dimension. As a somewhat more complex case which still lies within the limits of immediate comparison we have 3) *the equality of two differences between magnitudes*, especially when these magnitudes belong to neighboring parts of the same system. It is clear that in each of these three kinds of psychical measurements the two fundamental functions in apperceptive comparison, the perception of agreements and the perception of differences, are both applied together. In the first case one of two psychical magnitudes, A and B is gradually vared until it agrees for immediate comparison with the other; thus, for example, B is varied until it agrees with A. In the second case A and B are taken equal at first and then B is changed until it appears either just noticeably greater or just noticeably smaller than A. Finally, the *third* case is used to the greatest advantage when a whole line of psy-

chical magnitudes as, for example, of sensational intensities, extending from A as a lower limit to C as an upper limit, is so divided by a middle quantity B, which has been found by gradual variations, that the partial distance AB is apperceived as equal to BC.

Stimulus Threshold & Differe
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10. The most direct and most easily utilizable results derived from these methods of comparison are given by the *second* method, or the *method of minimal differences* as it is called. The difference between the physical stimuli which corresponds to the just noticeable difference between psychical magnitudes is called the *difference threshold of the stimulus*. The intensity at which the resulting psychical process, as for example, a sensation, can be just apperceived, is called the *stimulus threshold*. Observation shows that the difference threshold of the stimulus increases in proportion to the distance from the stimulus threshold, in such a way that the *relation* between the difference threshold and the absolute quantity of the stimulus, or the *relative difference threshold*, *remains constant*. If, for example, a certain sound the intensity of which is 1 must be increased $\frac{1}{3}$ in order that the sensation may be just noticeably greater, one whose intensity is 2 must be increased $\frac{2}{3}$, one 3 must be increased $\frac{3}{3}$, etc., to reach the difference threshold. This law is called *Weber's law*, after its discoverer E. H. WEBER. It is easily understood when we look upon it as a law of apperceptive comparison. From this point of view it must obviously be interpreted to mean that *psychical magnitudes can be compared only according to their relative values*.

Weber's La

This view that WEBER's law is an expression of the *general law of the relativity of psychical magnitudes*, assumes that the psychical magnitudes which are compared, themselves increase in direct proportion to their stimuli, within the limits of the validity of the law. It has not yet been possible to demonstrate the truth of this assumption on its physiological side, on account of the difficulties of measuring exactly the stimulation of nerves and sense-organs. Still, we have evidence in favor of it in the psychological fact that in certain special cases, where the conditions of observation lead very naturally to a comparison of absolute differences in magnitude, the absolute difference threshold, instead of the relative threshold, is found to be constant. We have such a case, for example, in the comparison, within wide limits, of minimal differences in pitch (p. 58). Then, too, in many cases where large differences in sensations are compared according to the third method described above (p. 282), equal absolute stimulus differences, not relative differences, are perceived as equal. This shows that apperceptive comparison may follow *two* different principles under different conditions: a principle of *relative* comparison (WEBER's law) which is the more general, and a principle of *absolute* comparison which takes the place of the first principle under special conditions which favor such a form of apperception.

Weber's Law in Detail & Methods for its demonstration

10a. *Weber's law* has been shown to hold, first of all, for the *intensity* of sensations and then, in a more limited way, for the comparison of *extensive* compounds, especially temporal ideas, and also, to some extent, for spacial ideas of sight and for motor ideas. On the other hand, it does not hold for the spacial ideas of external touch, obviously on account of the complexity of the local signs (p. 115); and it can not be verified for sensational *qualities*. The scale of tonal intervals is relative because every interval corresponds to a certain *ratio* between the number of vibrations (for example, an octave 1 : 2, a fifth 2 : 3, etc.). This is probably due to the relationship between clangs which is due to the relation of the fundamental tone to its overtones (comp. p. 105 sq.). Even when an *absolute* comparison takes place instead of a comparison according to WEBER's law of relativity, we must not confuse this with the establishment of an absolute measure.

That would presuppose an absolute unit, that is, the possibility of finding a constant standard, which, as noted above (p. 282), is in the psychical world impossible. Absolute comparison must take the form of a *recognition of the equality of equal absolute differences.* This is possible in certain single cases without a constant unit. Thus, for example, we compare two sensational lines AB and BC according to their *relative* values, when we think in both cases of the relation of the upper to the lower extreme sensation. In such a case, accordingly, we judge AB and BC to be equal when $\frac{B}{A} = \frac{C}{B}$ (WEBER's law). On the other hand, we compare AB and BC according to their *absolute* values when the difference between C and B in the single sensational dimension in question appears equal to that between B and A, that is, when $C - B = B - A$ (law of proportionality, MERKEL). The recognition of quantitative or qualitative difference is rendered more difficult when the two stimuli to be compared are presented in continuous sequence, and with neither a time or space interval separating them. The difference threshold is, accordingly, greater in such cases, and it grows still longer the more slowly the continuous transition from one stimulus to the other takes place. Thus, the threshold for brightness, when two distinct stimulations are compared with each other, is $^1/_{100}$ (p. 63). When, on the other hand, the two stimuli are not separate, but the first passes directly into the second, the threshold is $^7/_{100}$ if the transition is rapid and about $^{10}/_{100}$ if it is slow. The threshold for distinctly separated tones is $^1/_5$ vibrations (p. 58); for continuous tonal changes $^1/_3$ to $1^1/_2$ vibrations. The treshold for distinctly separated pressures is $^8/_{100}$ (p. 53); for continuous changes $^{10}/_{100}$ to $^{30}/_{100}$, the larger fraction represents the results of slow transitions. Even under the more difficult conditions of comparison described, WEBER's law holds true for those spheres of comparison to which it applies under any conditions.

By treating WEBER's law as an expression of the functional relation between sensation and stimulus and by assuming that the law is valid for infinitely small changes of both sensation and stimulus, FECHNER worked out the formula, $dE = C \cdot \frac{dR}{R}$ (R

represents the stimulus and E the sensation). From this formula he derived as the formula for finite sensation values and stimuli the following logarithmic expression $E = k \cdot \log R + c$. That is, the sensation is proportional in its increase to the logarithm of the stimulus, c and k representing constants which must be determined by experiment (FECHNER's Psycho-physical Law). This formula, however, because of its assumption of an immediate relation between sensation and stimulus, fails to indicate the fact that in all probability the law depends upon the *relation between the sensations measured.* If we recognize the relation as one between the sensations, we may adopt the formula $V = m \cdot \frac{\Delta E}{E}$. ΔE represents the difference threshold, V the ratio of comparison. This formula contains nothing but psychical magnitudes thus conforming to the probable significance of WEBER's law.

The methods for the demonstration of WEBER's law, or of other relations between psychical magnitudes, whether elementary or compound, are usually called *psycho-physical methods.* The name is unsuitable, however, because the fact that physical means are here employed is not unique, but holds for all the methods of experimental psychology. The methods could better be called "methods for the measurement of psychical magnitudes". With these methods it is possible to follow one of *two* courses in finding the relations mentioned as favorable for judgment. A first or *direct* mode of procedure is as follows: one of two psychical magnitudes A and B, as, for example, A, is kept constant, and B is gradually varied until it stands in one of the relations mentioned, that is, either equals A or is just noticeably greater or smaller, etc. These are the *adjustment methods.* Among these we have as the method frequently applied and that which leads most directly to conclusions, the "method of minimal changes", and then as a kind of modification of this for the case of adjustment in which equality is the end sought, the "method of average error". The second mode of procedure is to compare in a large number of cases any two stimuli, A and B, which are very little different, and to compute from the number of cases in which the judgments are $A = B$, $A > B$, $A < B$, the position of the relations mentioned, especially the difference threshold. These are the *calculation methods.* The chief of these is the method known as that of "right and wrong cases". It would be more proper to call it the "method of three cases" (equality, positive difference, and negative difference). Details as to this and the other methods belong in a special treatise on experimental psychology.

There are two other interpretations of Weber's law still met with besides the psychological interpretation given above; they may be called the *physiological* and the *psycho-physical* theories. The first derives the law from hypothetically assumed relations in the conduction of excitations in the central nervous system. The second regards the law as a specific law of the "interaction between body and mind". The physiological interpretation is entirely hypothetical and in certain cases, as, for example, for temporal and spacial ideas, entirely inapplicable. The psycho-physical interpretation of Fechner is based upon a view of the relation of mind which must be rejected by the psychology of to-day (cf. § 22, 8).

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Psychological contrast Phenomena

11. As special cases among the apperceptive comparisons generally falling under Weber's law, are the comparisons of magnitudes which are related to each other as *relatively greatest sensational differences* or, when dealing with feelings,

as *opposites.* The phenomena that appear in such cases are usually grouped together under the class name *contrasts.* In the department where contrasts have been most thoroughly investigated that is, in the case of *light sensations*, there is generally an utter lack of discrimination between two phenomena which are obviously entirely different in origin, though their results are to a certain extent related. We may distinguish these as light induction or *physiological* contrast (p. 78), and true contrast or *psychological* contrast. Physiological contrasts are closely connected with the phenomena of after-images, perhaps they are the same (p. 77 sq.). *Psychological* contrasts are essentially different; they are usually pushed into the background by the stronger physiological contrasts when the impressions are intense. Psychological contrasts are distinguished from physiological by two important 1st characteristics. First, psychical contrasts do not reach their greatest intensity when the brightness and saturation are greatest, but when the sensations are at the *medium* stages, where the eye is most sensitive to changes in brightness 2nd and saturation. Secondly, psychical contrasts can be removed by comparison with an independent object. Especially the latter characteristic shows these contrasts to be unqualifiedly the products of comparisons. Thus, for example, when a grey square is laid on a black ground and close by a similar grey square is laid on a white ground and all are covered with transparent paper, the two squares appear entirely different; the one on the black ground looks bright, nearly white, that on the white ground looks dark, nearly black. Now after-images and irradiations are very weak when the colors are thus seen through translucent media, so that it may be assumed that the phenomenon described is a psychical contrast. If, again, a strip of black cardboard which is also covered with the transparent paper, and therefore appears exactly the same grey as the two squares, is held in such a position that it connects the two squares, the contrast will be removed entirely, or, at least, very much diminished. If in this experiment a colored ground is used instead of the achromatic ground, the grey squares will appear very clearly in the corresponding complementary color. But here, too, the contrast can be made to disappear through comparison with an independent grey object.

Interconnection with the Physiology Contrast in [illegible]

12. Similar contrasts appear also in other spheres of sensation when the conditions for their demonstration are favorable. They are also especially marked in the case of feelings and may arise under proper conditions in the case of spacial and temporal ideas. Sensations of pitch are relatively most free, for most persons have a well developed ability to recognize absolute pitch and this probably tends to overcome contrast. In the case of *feelings* the effect of contrast is intimately connected with the natural opposition between affective qualities. Thus, pleasurable feelings are intensified by unpleasant feelings immediately preceding, and the same holds for many feelings of relaxation following feelings of strain, as, for example, a feeling of fulfilment after expectation. The effect of contrast in the case of spacial and temporal ideas is most obvious when the same spacial or temporal interval is compared alternately with a longer and with a shorter interval. In such cases the interval appears different, in comparison with the shorter it appears greater, in comparison with the longer, smaller. Here, too, the contrast between spacial ideas can be removed by bringing an object between the contrasted figures in such a way that it is possible easily to relate them.

Contrast between impression & expected

13. We may regard the phenomena which result from the apperception of an impression the *real* character of which differs from the character *expected*, as special modifications

of psychical contrast. For example, if we are prepared to lift a heavy weight, and find in the actual lifting of the weight that it proves to be light, or if we lift a heavy weight when we expected a light one, the result is in the first case an underestimation, in the second an overestimation of the real weight. If a series of exactly equal weights of different sizes are made to vary in size so that they look like a set of weights varying regularly from a lighter to a heavier, they will appear to be different in weight when raised. The smallest will seem to be the heaviest and the largest to be the lightest. The familiar association that the greater volume is connected with the greater mass determines in this case the tendency of expectation. The false estimation of the weight then results from the contrast between the real and the expected sensation.

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B. COMPLEX APPERCEPTIVE FUNCTIONS.

(Synthesis and Analysis.)

Aggregate Ideas

14. When the simple processes of relating and comparing are repeated and combined several times, the complex psychical functions of *synthesis* and *analysis* arise. *Synthesis* is primarily the product of the *relating* activity of apperception, *analysis* of the *comparing* activity.

As a combining function *apperceptive synthesis* is based upon fusions and associations. It differs from fusions and associations in the fact that some of the ideational and affective elements which are brought forward by the association are voluntarily emphasized and others are pushed into the background. The motives of the choice can be explained only from the whole previous development of the individual consciousness. As a result of this voluntary activity the product of this synthesis is a complex in which all the components are derived from former sense perceptions and associations, but in which the combination of these components may differ more or less from the original forms.

The ideational elements of a compound thus resulting from apperceptive synthesis may be regarded as the substratum for the rest of its contents, and so we call such a compound in general an *aggregate idea.* When the combination of the elements is peculiar, that is, markedly different from the products of associations, the aggregate idea and each of its relatively independent ideational components is called an *idea of imagination* or *image of imagination.* Since the voluntary synthesis may vary more or less from the combinations presented in sense perception and association, it follows that practically no sharp line of demarcation can be drawn between images of imagination and those of memory. But we have a more essential mark of the apperceptive process in the positive characteristic that it depends on a voluntary synthesis than in the negative fact that the combination does not correspond in character to any particular sense perception. This positive characteristic is also the source of a most striking difference between images of imagination and those of memory. This difference consists in the fact that the sensational elements of an apperceptive compound are much more like those of an immediate sense perception in clearness and distinctness, and usually also in completeness and intensity. This is easily explained by the fact that the reciprocally inhibitory influences which the uncontrolled associations exercise on one another, and which prevent the formation of fixed memory images, are diminished or removed by the voluntary emphasizing of certain particular ideational compounds. It is possible to mistake images of imagination for real experiences. In the case of memory images this is possible only when they become images of imagination, that is, when the memories are no longer allowed to arise passively, but are to some extent produced by the will. Generally, there are such voluntary modifications of memories through a mixing of real with imagined elements. All our memories are therefore made up of "fancy and truth"[1]. Memory images thus change under the influence of our feelings and volition to images of imagination, and we generally deceive ourselves with their resemblance to real experiences. Psych analysis of activity of Imagination

15. From the aggregate ideas which thus result from apperceptive synthesis there arise *two forms of apperceptive analysis* which work themselves out in opposite directions. The one is known in popular parlance as activity of the *imagination*, the second as activity of the *understanding*. The two are by no means absolutely different, as might be surmised from these names, but are, rather, closely related and almost always connected with each other. Their fundamental determining motives are what distinguish them and condition all their secondary differences and also the reaction that they exercise on the synthetic function.

In the case of the activity of "*imagination*" the motive is the *reproduction of real experiences or of experiences analogous to reality*. This is the earlier form of apperceptive analysis and arises directly from association. It begins with a more or less comprehensive aggregate idea made up of a variety of ideational and affective elements and embracing the general content of a complex experience in which the single components are only indefinitely distinguished. The aggregate idea is then divided in a series of successive acts into a number of more definite, connected compounds, partly spacial, partly temporal in character. The primary voluntary synthesis is thus followed by analytic acts which may in turn give rise to the motives for a new synthesis and thus to a repetition of the whole process with a partially modified, or more limited aggregate idea.

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[1] "Dichtung und Wahrheit".

The activity of imagination shows *two* stages of development. The first is more *passive* and arises directly from the ordinary memory function. It appears continually in the train of thought, especially in the form of an anticipation of the future, and plays an important part in psychical development as a preparation or antecedent of volitions. It may, however, in an analogous way, appear as a representation in thought of imaginary situations or of successions of external phenomena. The second, or *active*, form of imagination is under the influence of a fixed idea of some end, and therefore presupposes a high degree of voluntary control over the images of imagination, and a strong interference, partly inhibitory, partly selective, with the memory images that tend to push themselves into consciousness without voluntary action. Even the first synthesis of the aggregate idea is more systematic when produced by this active process. And an aggregate idea, when once formed in this way, is held more firmly and subjected to a more complete analysis. Very often the components themselves are subordinate aggregate ideas to which the same process of analysis is again applied. In this way the principle of organic division according to the end in view governs all the products and processes of active imagination. The productions of *art* show this most clearly. Still, there are, in the ordinary play of imagination, the most various intermediate stages between passive imagination, or that which arises directly from memory, and active imagination, or that which is directed by fixed ends. Psych characts of the acti of under

16. In contrast with this imagination or imaginative reproduction of real experiences, or of experiences which may be thought of as real, the function of the "*understanding*" is the *perception of agreements and differences and other derived logical relations between contents of experience.* Understanding also starts with aggregate ideas in which a number of experiences that are real or may be ideated as real, are voluntarily set in relation to one another and combined into a unitary whole. The analysis that takes place in this case, however, is turned by its fundamental motive in a different direction. Such analysis consists not merely in a clearer grasp of the single components of the aggregate idea, but it consists also in the establishment of the manifold relations which exist between the various components and which we may discover through comparison. In establishing such relations it is possible, as soon as analyses have been made several times, to introduce into any particular case the results gained through relating and comparing processes carried out on other occasions.

As a consequence of this more strict application of the elementary relating, and comparing functions, the activity of understanding follows definite rules even in its external form, especially when it is highly developed. The fact which showed itself in the case of imagination and even of memory, appears here in a developed form. The fact in question is, that the apperceived relations between the various psychical contents are presented in imagination and memory, not merely simultaneously, but *successively*, so that we proceed from one relation to the next, and so on. In the case of understanding, this successive presentation of relations develops into the *discursive division of the aggregate idea.* This is expressed in the law of the *duality of the logical forms of thought*, according to which, analysis resulting from relating comparison divides the content of the aggregate idea into *two* parts, subject and predicate, and may then separate each of these parts again once or several times. These secondary divisions give rise to grammatical forms that stand in a logical relation analogous to that of subject and predicate, such as noun and attributive, verb and object, verb and adverb. In this way the process of apperceptive analysis results in a *judgment* which finds expression in the *sentence*.

For the psychological explanation of judgment it is of fundamental importance that judgment be regarded, not as a synthetic, but as an *analytic* function. The original aggregate ideas which are divided by judgment into their reciprocally related components, are exactly like ideas of imagination. The products of analysis which result from judgment are, on the other hand, not as in the case of imagination, images of more limited extent and greater clearness, but *conceptual ideas*, that is, ideas which stand, with regard to other partial ideas of the same whole, in some one of the relations which are discovered through the general relating and comparing functions. If we call the aggregate idea which is subjected to such a relating analysis a *thought*, then a *judgment* is a division of this thought into its components, and a *concept* is the product of such a division.

Psych. Char. of Concepts

17. Concepts found in this way are arranged in certain general classes according to the character of the analyses

that produced them. These classes are the *concepts of objects*, *concepts of attributes*, and *concepts of states*. Judgment as a division of the aggregate idea, sets an object in relation to its attributes or states, or it sets various objects in relation to one another. Since a single concept can never, strictly speaking, be thought of by itself, but is always connected in the whole idea with one or more other concepts, the conceptual ideas are strikingly different from the ideas of imagination because of the indefiniteness and variableness of the former. This indefiniteness is essentially increased by the fact that as a result of the like outcome of different kinds of judgment, concepts arise which may form components of many ideas that differ in their concrete characters. Such *general* concepts constitute, on account of the wide application of relating analysis to different contents of judgment, the great majority of all concepts; and they have a greater or smaller number of corresponding single ideational contents. A *single* idea is selected from this group of contents as a representative of the concept. This gives the conceptual idea a greater definiteness. At the same time there is always connected with this idea the consciousness that it is merely a representative. This consciousness generally takes the form of a characteristic feeling, the *conceptual feeling*. This feeling may be traced to the fact that obscure ideas, which have the attributes that make them suitable to serve as representations of the concept, tend to force themselves into consciousness in the form of memory images. As evidence of this we have the fact that the feeling is very intense when any concrete image of the concept is chosen as its representative, as, for example, when a particular individual stands for the concept man, while it disappears almost entirely as soon as the representative idea differs entirely in content from the objects included under the concept. *Word ideas* fulfil this latter condition and that is what gives them their importance as universal aids to thought. Word ideas are furnished to the individual consciousness in a finished state, so that we must leave to social psychology the question of the psychological development of the processes of thought which are active in their formation (comp. § 21, A). Imag. and Underst. as Indiv. Trai

Talen

18. From all that has been said it appears that the activities of imagination and understanding are not specifically different, but interrelated; that they are inseparable in their rise and manifestations, and are based at bottom on the same fundamental functions of apperceptive synthesis and analysis. What was true of the concept "*memory*" (p. 272), holds also of the concepts "*understanding*" and "*imagination*": they are names, not of unitary forces or faculties, but of complex phenomena made up of the usual elementary psychical processes, not of elementary processes of a specific, distinct kind. Just as memory is a general concept for certain associative processes, so imagination and understanding are general concepts for particular forms of apperceptive activity. They have a certain practical value as ready means for the classification of a variety of differences in the capacity of various persons for intellectual activity. Each class thus found may in turn contain an endless variety of gradations and shades. Thus, neglecting the general differences in grade, we have as the chief forms of individual imagination the *perceptive* and *combining* forms; as the chief forms of understanding, the *inductive* and *deductive* forms, the first being mainly concerned with the single logical relations and their combinations, the second more with general concepts and their analysis. A person's *talent* is his total capacity resulting from the special tendencies of both his imagination and understanding.

References. WUNDT, Lectures on Hum. and Anim. Psych., lecture 21, and Logik, vol. I, chap. 1 and Völkerpsychologie, vol. I, Pt. 2, chap. 7.

§ 18. PSYCHICAL STATES.

1. The normal state of consciousness upon which the discussion of the foregoing paragraphs has been based may undergo such a variety of changes that general psychology must give up the attempt to discuss these changes in detail. Then, too, the more important of these changes, namely, those which are observed in the various forms of nervous diseases, brain-diseases, and insanity, belong to special branches of pathology which border upon psychology and are more or less dependent upon it. All that psychology can do is to indicate the main psychical conditions for abnormal states. We may distinguish in general *three* kinds of such conditions. They may consist 1) in the abnormal character of the psychical *elements*, 2) in abnormalities in the way in which psychical *compounds* are constituted, and 3) in abnormalities in the way in which psychical compounds are *combined*. As a result of the intimate interconnection of these different kinds of conditions it hardly ever happens that one of these three conditions is operative alone; all three usually unite. The abnormal character of the elements results in abnormalities of the compounds, and this in turn brings about changes in the general interconnection of conscious processes.

2. The *psychical elements*, that is, sensations and simple feelings, show only such changes as result from some disturbance in the normal relation between them and their psycho-physical conditions. In the case of sensations such changes may be reduced to an increase or decrease of the sensitivity for stimuli (hyperaesthesia and anaesthesia) result-

ing especially from the action of certain physiological influences within the sensory centres. The most important psychological symptom in this case is the *increased excitability* which is one of the most common factors of complex psychical disturbances. In similar fashion, changes in the simple feelings betray themselves in states of depression or exaltation as a decrease or increase in the affective excitability. These different states may be recognized from the way in which the emotions and volitional processes occur. Thus, changes in the psychical elements can be demonstrated only by the influence that they exercise on the character of the various psychical compounds.

3. The defects in *ideational compounds* arising from peripheral or central anaesthesia are generally of limited importance. They have no far-reaching effect on the interconnection of psychical processes. It is essentially different with the relative *increase* in the sensation which results from central hyperaesthesia. The effect of such hyperaesthesia is especially important because when it is present, reproduced sensational elements may become as intense as external sense impressions. The result may be that a pure memory image is objectified as a sense perception. This is an *hallucination*. Or, when elements are united which are partly from direct external stimulation, partly from reproduction, the sense impression may be essentially modified through the intensity of the reproduced elements. The result is then an *illusion of fancy*[1]). The two abnormalities are not always distin-

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[1]) The expression "illusions of fancy" is used when this class of illusions is to be distinguished from the sense illusions that appear in the normal state of consciousness, as, for example, from the radiating form of the stars, which is due to the refraction of light in the crystalline lens, or the varying apparent size of the sun or moon at the horizon and at the zenith.

guishable, for though in many cases particular ideas can be shown to be illusions of fancy, the presence of pure hallucinations is almost always doubtful because it is so easy to overlook some direct sensational elements. In fact, it is by no means improbable that the great majority of so-called hallucinations are illusions. These illusions are in their psychological character nothing but *assimilations* (p. 251 sq.). They may be defined as assimilations in which the reproduced elements predominate. Just as normal assimilations are connected with successive associations, so for the same reason, the illusions of fancy are closely related to the changes in the associative ideational processes to be discussed later (5).

4. In the case of complex *affective* and *volitional processes* the abnormal states are clearly distinguishable as states of *depression* and *exaltation*. The state of depression is due to the predominance of inhibitory, asthenic emotions, that of exaltation to a predominance of exciting, sthenic emotions, while at the same time we observe, in the first case a retardation or complete checking of resolution, in the second an exceedingly rapid, impulsive activity of the motive. In this sphere it is generally more difficult to draw the line between normal and abnormal conditions than in the sphere of ideational compounds, because even in normal mental life the affective states are continually changing. In pathological cases the change between states of depression and exaltation, which are often very striking, appear merely as intensification of the normal oscillation of the feelings and emotions about an indifference-condition (pp. 87, 186). States of depression and exaltation are especially characteristic symptoms of general psychical disturbances; their detailed discussion must therefore be left to psychical pathology. General psychical disturbances are always symptoms of dis-

eases of the brain, so that these abnormalities in affective and volitional processes are doubtless accompanied, like abnormalities of the sensations and ideas, by physiological changes. The nature of these changes is, however, still unknown. We can only surmise, in accordance with the more complex character of affective processes, either that they are more extensive than the changes in central excitability accompanying hallucinations and illusions, or that they affect the central cortial regions directly concerned in apperceptive processes.

5. Connected with these changes in the sensory excitability and with states of depression and exaltation, there are, as a rule, simultaneous changes in the interconnection and course of psychical processes. Using the concept consciousness which we employ to express this interconnection (p. 223), we may call these changes *abnormal changes of consciousness*. So long as the abnormality is limited to the single psychical compounds, ideas, emotions, and volitions, consciousness is of course changed because of the changes in its components, but we do not speak of an abnormality of consciousness itself until not merely the single compounds, but also the combinations of these compounds, exhibit some noticeable abnormalities. Such changes in the combinations always arise when the elementary disturbances become greater, because the combinations of elements into compounds and of compounds with one another, are processes that pass continuously into each other. Corresponding to the different kinds of combination which make up the interconnection of consciousness (p. 244), there may be distinguished in general *three* kinds of abnormalities of consciousness: 1) changes in the associations, 2) changes in the apperceptive combinations, and 3) changes in the relation of the two forms of combination.

6. *Changes in associations* are the first to result directly from the elementary disturbances. The increase of sensory excitability changes normal assimilations into illusions of fancy, and this results in an essential disturbance in the associative processes of recognition (p. 261). Sometimes that which is known to the subject appears to be unknown, and then again what is unknown appears familiar, according as the reproduced elements are connected with definite earlier ideas, or are derived from perceptions which have only a remote relation to one another. Then, too, the increased sensory excitability tends to accelerate the association, so that the most superficial connections, which are occasioned by accidental impressions or by habit, are the ones that predominate. The states of depression and exaltation, on the other hand, determine mainly the quality and direction of the association.

In a similar manner the elementary ideational and affective changes influence *apperceptive combinations*, either retarding or accelerating them, or else determining their direction. Still, in these cases all marked abnormalities in ideational or affective processes result in an increase, to a greater or less degree, of the difficulty of carrying out the processes connected with active attention, so that often, only the simpler apperceptive combinations are possible, sometimes only those are possible which through practice have become simple associations. Connected with the last mentioned fact are the changes that take place in the relation between apperceptive and associative combinations. The influences discussed thus far are in the main favorable to associations, but unfavorable to apperceptive combinations. In keeping with this is the fact that one of the most frequent symptoms of a far-reaching psychical abnormality is a great preponderance of associations. This is most obvious when the disturbance of consciousness is a continually increasing process, as it is in many cases of insanity. The observation may be made in such cases that the functions of apperception, that is, the so-called processes of imagination and understanding are more and more supplanted by associations, until finally the latter are all that remain. If the disturbance progresses still further, the associations gradually become more limited and confined to certain habitual combinations (fixed ideas). Finally this state gives place to one of complete mental paralysis.

7. Apart from mental diseases in the strict sense of the term', the irregularities of consciousness just discussed are to be found in two conditions that appear in the course of normal life: in *dreams* and *hypnosis.*

The ideas which arise in *dreams* come, at least to a great extent, from sensations, especially from those of the general sense, and are therefore mostly illusions of fancy, probably only seldom pure memory ideas that have become hallucinations. The decrease of apperceptive combinations in comparison with associations, is also striking and goes to explain the frequent modifications and exchanges of self-consciousness, the confusion of the judgment, etc. The characteristics of dreams which distinguish them from other similar psychical states, are to be found, not so much in these positive attributes, as in certain negative attributes. The increase of excitability is limited entirely to the *sensory* functions, the external volitional activity being in ordinary sleep and dreams completely inhibited. When the fanciful ideas of dreams are connected with corresponding volitional acts, we have the very infrequent phenomena of *sleep-walking*, which are related to certain forms of hypnosis. Motor concomitants are generally limited to articulations, and appear as talking in dreams.

8. *Hypnosis* is the name applied to certain states related to sleep and dreams and produced by means of certain definite psychical agencies. Consciousness is here generally in a condition halfway between waking and sleeping. The main cause of hypnosis is *suggestion*, that is, the communication of an idea strong in affective tone. This communication generally takes the form of a command from some other person (outward suggestion), but may sometimes be given by the subject himself, when it is called autosuggestion. The command or resolution to sleep, to make certain movements, to perceive certain objects which are not present, or not to perceive objects which are present, etc., — these are the most frequent suggestions. Monotonous stimuli, especially tactual stimuli are helpful auxiliaries. Then, too, there is a certain disposition of the nervous system of unknown character, which is necessary for the rise of the hypnotic state and this disposition is decidedly increased when the state is repeatedly produced.

The first symptom of hypnosis is the more or less complete inhibition of external volitional acts. This is connected with a concentration of the attention on one thing, generally the command of the hypnotizer (automatism). The subject not only sleeps at command, but retains in this state any position that is given him, however unnatural (hypnotic catalepsy). If the sleep becomes still deeper the subject makes, to all appearances automatically, the movements which he is directed to make, and he shows that ideas suggested to him appear like real objects (somnambulism). In this last state it is possible to give either motor or sensory suggestions which are to go into effect when the subject awakes, or even at some later time (terminal suggestions). The phenomena that accompany such "posthypnotic effects" render it probable that the after-effects are due either to a partial persistence of the hypnosis or (in the case of terminal suggestions) to a renewal of the hypnotic state.

9. It appears from all these phenomena that sleep and hypnosis are related states, differing only in the fact that their mode of origin is different. They have as common characteristics the inhibition of processes of volition and attention, and a disposition toward aroused excitability in the sensory centres that brings about an assimilation of the sense impressions and thus results in illusions of fancy. The characteristics which distinguish sleep and hypnosis are the complete inhibition of volition in sleep, especially of the apperceptive function and of every phase of motor function, and the concentration in hypnosis of the passive attention on one thing. This concentration is conditioned by suggestion and is at the same time favorable to the reception of further suggestions. These differences are, however, not absolute, for in sleep-walking the will is not completely inhibited, while, on the other hand, it is inhibited in the first lethargic stages of hypnosis just as in ordinary sleep.

Sleep, dreams, and hypnosis are, accordingly, in all probability, essentially the same in their psychophysical conditions. These conditions consist in the specially modified dispositions to sensational and volitional reactions, and can, therefore, like all such dispositions, be explained on their physiological side only by assuming changes in the activity of certain central regions. These changes have not yet been investigated directly. Still, we may assume from the psychological symptoms that the physiological conditions consist as a rule, in the inhibition of activity in the regions connected with processes of volition and attention, and in increased excitability of the sensory centres.

9a. It is then, strictly speaking, a *physiological* problem to formulate a theory of sleep, dreams, and hypnosis. Apart from the general assumption based on psychological symptoms, of an inhibition of activity in certain parts of the cerebral cortex, and increase in the activity of other parts, we can apply only one general neurological principle with any degree of probability. This is the principle of *compensation of functions*, according to which the inhibition of the activity of one region is always connected with an increase in the activity of the other interrelated areas. This interrelation may be either direct, *neurodynamic*, or indirect, *vasomotoric*. The first is probably due to the fact that energy which accumulates in one region as the result of inhibition, is discharged through the connecting fibres into other central regions. The second is due to contraction of the capillaries as a result of inhibition and a compensating dilation of the blood-vessels in other regions. The increased blood supply due to this dilation is in turn attended by an increase in the activity of the region in question. Judging from the psychological symptoms, one of the essential differences between dreams and hypnosis seems to consist in the fact that in dreams the central regions which are related to apperception are in a more or less completely inactive state, so that all stimulations flow, according to the principle of compensation, to the sensory centres. In hypnosis, on the other hand, it is possible for different regions within the apperception centre itself to be so related that while certain of these regions are partially inhibited, others are correspondingly more open to excitation. This line of inference seems to be justified by the examination of certain states of partial hypnosis which may arise through an increased disposition on the part of a subject to become hypnotized, which increased disposition results from practice. In such states of partial hypnosis the subject may carry out in an automatic way complicated acts, all his other functions seeming to be in a waking state. Or he may show certain psychological activities of clearer discrimination, or strikingly exact recognition, or reproduction of certain particular sensations and feelings to the exclusion of all other forms of activity. This last mentioned state of partial hypnosis in which attention is concentrated in a single direction is the only form of hypnosis which can possibly be thought of as having any direct psychological value. This state may be of some value because of the introspection which it renders possible in response to experimentally prepared sensory stimulations. But even in this state the greatest possible care will be necessary to avoid one danger which will always be present, namely, the danger that deceptive suggestions from others or from one's self are interfering with the introspection.

Dreams and hypnosis are often made the subjects of mystical and fanciful hypotheses, in some cases even by psychologists. We hear of increased mental activity in dreams and of influence of mind on minds at a distance in dreams and hypnosis. Especially hypnotism has been used in this way, to support superstitious spiritualistic ideas. In connection with "animal magnetism", which may be completely explained by the theory of hypnosis and suggestion, and in connection with "somnambulism", there are a great many cases of self-deception and intentional humbug. In reality all that can stand the light of thorough examination in these phenomena is in general readily explicable on psychological and physiological grounds; what is not explicable in this way has always proved on closer examination to be superstitious self-deception or intentional fraud.

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IV. PSYCHICAL DEVELOPMENTS.

§ 19. PSYCHICAL ATTRIBUTES OF ANIMALS.

1. The animal kingdom exhibits a series of mental developments which may be regarded as antecedents to the mental development of man, for the mental life of animals shows itself to be throughout, in its elements and in the general laws governing the combination of these elements, the same as the mental life of man.

Even the lowest animals (protozoa and coelenterata) manifest vital phenomena that allow us to infer ideational and volitional processes. They seize their food, to all appearances spontaneously; they flee from pursuing enemies, etc. There are also to be found in the lowest stages of animal life traces of associations and reproductions and especially processes of sensible cognition and recognition (p. 261). In the higher animals these function reach a more advanced stage of development only through the increase in the length of time through which the memory processes extend. Furthermore, from the fact that structure and development of the sense organs is similar in man and animals, we must draw the conclusion that the character of the sense ideas is in general the same, the only difference being that in the lowest forms of life the sensory functions are limited to the general sense of touch, just as they are in the case of the higher organisms in the first stages of their individual development (p. 51).

In contrast with this uniformity of psychical elements and their simpler combinations, there are great differences in all the processes connected with the development of *apperception*. *Passive* apperception is never absent as the basis of the simple impulsive acts which are found everywhere, but *active* apperception in the form of voluntary attention to certain impressions and choice between different motives, probably never exists except in the higher animals. Even here it is limited to the ideas and associations aroused by immediate sensible impressions, so that we can find even in animals with the highest mental development certainly nothing more than the first beginnings of *intellectual* processes in the proper sense of the word, that is, of activities of imagination and understanding. Indeed, it may be questioned whether even these first beginnings are here present. Connected with this fact is the fact that higher animals have no developed language, though they are able to give expression to their emotions and even their ideas, when these ideas are connected with emotions, through various expressive movements which are frequently related to those of man.

2. Though the development of animals is in general far behind that of man, in spite of the qualitative likeness of the fundamental psychical processes, still, in two ways it is often superior. First, animals reach psychical maturity *much more rapidly*, and secondly, certain *single functions* particularly favoured by the special conditions under which the species lives, are often more highly developed. The fact of more rapid maturity is shown by the early age at which many animals (some immediately after birth) are able to receive relatively clear sense impressions and to execute purposive movements. To be sure, there are very great differences among higher animals in this respect. For example, the

chick just out of the shell begins to pick up grain, while the pup is blind at birth, and is for a long time after birth clumsy in his movements. Yet, the development of the child seems to be the slowest and the most dependent on help and care from others.

3. The special *one-sided development* of *single functions* in some animals is even more striking. These functions show themselves in certain *impulsive acts* regularly connected with the satisfaction of certain needs, either of alimentation, reproduction, or protection, and in the development of the sense perceptions and associations that form the motives for such acts. Such specially developed impulses are called *instincts.* The assumption that instincts belong only to animal and not to human consciousness is, of course, entirely unpsychological, and contradictory to experience. The disposition to manifest the general animal impulses, namely, the alimentive impulses and sexual impulses, is just as much a connate attribute of man as of the animals. The only thing that is characteristic of animals is the special highly developed form of the purposive acts by which many animals reach the ends aimed at. Different animals, however, are very different in this respect. There are numerous lower and higher animals whose acts resulting from connate instincts show as few striking characteristics as those of men. It is also noteworthy that domestication generally tends to do away with the instincts that animals had in their wild state, and to develop new ones which may generally be regarded as modifications of the wild instincts. This is seen, for example, in the instincts of certain hunting dogs, especially those of bird-dogs and pointers. The relatively high development of certain special instincts in animals as compared with men, is simply a manifestation of the general unsymmetrical development of animals. The whole psychical life

of animals consists almost entirely of the processes that are connected with the predominating instinct.

4. In general, instincts may be regarded as *impulsive acts* that arise from particular sensations and feelings. The physiological sources of the sensations chiefly concerned in instincts are the alimentary and genital organs. All animal instincts may, accordingly, be reduced to *alimentive* and *sexual* instincts, though in connection with the latter, especially in their more complex forms, there are always auxiliary protective and social impulses which may be regarded, from the character of their origin, as special modifications of the sexual impulse. Among these auxiliary forms must be classified the impulses of many animals to build houses and nests, as is the case with beavers, birds, and numerous insects (for example, spiders, wasps, bees, ants), and also the instinct of animal marriage found chiefly among birds and appearing both in the monogamic and polygamic forms. Finally, the so-called "animal states", as those of the bees, of ants, and of termites, belong under this head. They are in reality not states, but sexual communities, in which the social impulse that unites the individuals, as well as the common protective impulse, are modifications of the reproduction impulse.

In the case of all instincts the particular concrete impulsive acts arise from certain sense stimuli partly external, partly internal. The acts themselves are to be classed as impulsive acts, or simple volitions, since they are preceded and accompanied by particular sensations and feelings which serve as simple motives. The complex, connate character of these acts can be explained only from general inherited attributes of the nervous system, as a result of which connate reflex mechanisms are immediately, without practice on the part of the individual, set in action by certain stimuli. The purposive character of these mechanisms must also be regarded as a product of *general* psycho-physical development. As further evidence of this we have the fact that instincts show not only various modifications in different individuals, but they also show a certain degree of higher development through individual practice. In this way, the bird gradually learns to build its nest better; bees accommodate themselves to changing needs, instead of sending out new colonies they enlarge the hive if they have the necessary room. Even abnormal habits may be acquired by a single community of bees or ants; bees, for example, may learn to rob a neighbouring hive instead of gathering the honey from the flowers, or ants may acquire the remarkable habit of making the members of another species slaves, or of domesticating plant-lice for the sake of their honey. The rise, growth, and transmission of these habits, as we can trace them, show clearly the way in which all complicated instincts may arise. An instinct never appears alone, but there are always *simpler* forms of the same instinct in related classes and species. Thus the hole that the wall-wasp bores in the wall in which to lay her eggs, is a primitive pattern of the ingenious hive of the honey-bee. Between these two extremes there is, as the natural transition stage, the hive of the ordinary wasp made of a few hexagonal cells constructed of cemented sticks and leaves.

We may, accordingly, explain the complex instincts as developed forms of originally simple impulses which have gradually differentiated more and more in the course of numberless generations, through the gradual accumulation of habits that have been acquired by individuals and then transmitted. Every single habitual act is to be regarded as a stage in this psychical development. The gradual passage of a habit into a connate disposition is to be explained as a psycho-physical process of practice through which complex volitional acts gradually pass into automatic movements following immediately and reflexly the appropriate impression.

5. If we try to answer the general question of the *genetic relation of man to the animals* on the ground of a comparison of their psychical attributes, it must be admitted, in view of the likeness of psychical elements and of their simplest and most general forms of combination, that it is possible that human consciousness has developed from a lower form of animal consciousness. This assumption is also rendered stronger by the fact that the animal kingdom presents a whole series of different stages of psychical development and that every human individual passes through an analogous development. The doctrine of psychical development thus confirms in general the results of the theory of physical evolution. Still we must not overlook the fact that between the *psychical* attributes of man and those of the animals, as expressed in the intellectual and affective processes resulting from apperceptive combinations, there are differences much broader than the differences in their physical characteristics. Then, too, the great stability of the psychical condition of animals, which condition undergoes little change even in domestication, renders it exceedingly improbable that any of the present animal forms will develop in their psychical attributes, much beyond the limits that they have already reached.

5a. The attempts to define the relation of man and animals from a psychological point of view vary between two extremes. One of these is the predominating view of the old psychology that the higher "faculties of mind", especially "reason", are entirely wanting in animals, or that, as DESCARTES held, animals are mere reflex mechanisms without mind. The other is the wide-spread opinion of representatives of special animal psychology, that animals are essentially equal to man in all respects, in ability to consider, to judge, to draw conclusions, in moral feelings, etc. With the rejection of faculty-psychology the first of these views becomes untenable. The second rests on the tendency prevalent in popular psychology to interpret all objective phenomena in terms of human thought, especially in terms of logical reflection. The closer analysis of so-called manifestations of intelligence among animals shows, however, that they are in all cases fully explicable as simple sensible recognitions and associations, and that they lack the characteristics belonging to concepts proper and to logical operations. But associative processes pass without a break into apperceptive, and the beginnings of the latter, that is simple acts of active attention and choice, appear without any doubt in the case of higher animals, so that the difference is after all more one of the degree and complexity of the psychical processes than a difference in kind.

Animal instincts presented a very great difficulty to the older forms of psychology, such as the faculty theory and the intellectualistic theories (§ 2). There the attempt to deduce these instincts from the conditions given in each individual case led to an improbably high estimation of the psychical ability of the animal, especially when the instinct was more complex. As a result, the conclusion was often accepted that instincts are incomprehensible, or, what amounts to the same thing, due to connate ideas. This "enigma of the instincts" ceases to be an enigma when we come to look upon instincts, as we have done above, as special forms of impulsive action, and consider them as analogous to the simple impulsive acts of men and animals, for which we have a psychological explanation. This is especially true when we follow the reduction of what were originally complicated acts, to impulsive or reflex movements in the phenomena of habit. Such reduction can be easily observed in the case of man, as, for example, in the habituation to complex movements in learning to play the piano (comp. p. 212 sq.). It is often argued against this theory of instinct that it is impossible to prove empirically the transmission of acquired individual variations which we have assumed; that, for example, there are no certain observations in proof of the transmission of mutilations, as was formerly so frequently asserted. Many biologists accept the view that all the properties of the organism arise through the selection resulting from the survival of the individual best adapted to natural conditions; that all such properties of the individual are accordingly deducible from "natural selection", and that in this way alone changes can be produced in the germ and transmitted to descendants. Though it is admitted that an attribute acquired by a *single* individual, generally has no effect on the descendents, still, there is no apparent reason why habitual acts, which are indeed indirectly due to outer natural conditions, but depend primarily on the inner psycho-physical attributes of the organism, may not, just as well as the direct influences of natural selection, cause changes in the nature of the germ, at least, when the acts in question are repeated through many generations. Further evidence in favor of the view we have been defending is to be found in the fact that in some cases whole families inherit peculiar expressive movements or technical ability in some line. This does not exclude in any case the cooperation of natural influences, but is in full agreement with the facts of observation which show that these influences act in two ways: first, directly in the changes that natural selection brings about in the organism while the organism remains passive, and secondly, indirectly in the psycho-physical reactions which are caused by the outer influences, and which then in turn give rise to changes in the organism. If we neglect the latter fact, we not only lose an important means of accounting for the purposive character of organisms, but further, and more especially, we render impossible a psychological explanation of the gradual development of volition and its retrogradation into purposive reflexes as we see those processes in a large number of connate expressive movements (§ 20, 1).

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§ 20. PSYCHICAL DEVELOPMENT OF THE CHILD.

Devel of Sense function

1. The fact that the psychical development of man is regularly slower than that of most animals is to be seen in the much more gradual maturing of the child's *sense functions*. The child, to be sure, reacts immediately after birth to all kinds of sense stimuli, most clearly to impressions of touch and taste, with the least certainty to those of sound. Still, it is impossible to doubt that the special forms of the reaction movements in all these cases are due to inherited reflexes. This is especially true of the child's crying when affected by cold and tactual impressions, and of the mimetic reflexes when he tastes sweet, sour, or bitter substances. It is probable that all these impressions are accompanied by obscure sensations and feelings, yet the character of the movements can not be explained from the feelings, the symptoms of which they may be considered to be, but must be referred to connate central reflex tracts.

Clearly conscious experiences begin to show themselves after the end of the first month, but they are, as the rapid change of moods shows, sensations and feelings of a very changeable character. This date of the first rise of experience is fixed by the fact that we begin to observe symptoms, not only of unpleasurable feelings, but those of pleasurable feelings also in the child's laughter, and in lively rhythmical movements of his arms and legs after certain sense impressions. Even the reflexes are not completely developed at first — a fact which we can easily understand when we learn from anatomy that many of the connecting fibres between the cerebral centres do not develop until after birth. Thus the associative reflex-movements of the two eyes are wanting. To be sure, from the first, each of the eyes generally turns by itself towards a light. The movements of the two eyes are entirely irregular, and it is only in the course of the first three months that the normal coordination of the movements of the two eyes towards a common fixation-point, begins to appear. Even then the developing regularity of movement is not to be regarded as a result of complete visual perceptions, quite the reverse, it is to be recognized that this regularity of movement is an external manifestation of the gradual functioning of a reflex-centre, which then renders complete perception possible.

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2. It is impossible to gain any adequate information about the qualitative relations of *psychical elements* in the child's consciousness, for the reason that we have no certain objective symptoms. It is probable that the number of different tonal sensations, perhaps also the number of color sensations, is very limited. The fact that children two years old not infrequently use the wrong names for colors ought not however, to be looked upon as unqualified evidence that they do not have the sensation in question. It is much more probable that lack of attention and a confusion of the names is the real explanation in such cases.

Towards the end of the first year the *differentiation of feelings* and the related development of the various emotions take place and show themselves strikingly in the characteristic expressive movements that gradually arise. We now observe unpleasurable feelings and joy, and then in succession, astonishment, expectation, anger, shame, envy, etc. Even in these cases the physiological dispositions for the combined movements which express the single emotions, depend upon inherited physiological attributes of the nervous system which generally do not begin to function until after the first few months. As further evidence of such a view of hereditary transmission, we have DARWIN's observation that not infrequently special peculiarities in expressive movements show themselves in whole families.

Rise of Special Ideas

3. The physical conditions for the rise of *spacial ideas* are connate in the form of inherited reflex connections which make a relatively rapid development of these ideas possible. But for the child the spacial perceptions seem at first to be much more incomplete than are such perceptions in the case of many animals. There are manifestations of pain when the skin is stimulated, but no clear symptoms of localization. Distinct grasping movements develop gradually from the aimless movements that are observed even in the first days, but they do not, as a rule, become certain and consciously purposive until aided by visual perceptions, after the twelfth week. The turning of the eye toward a source of light which is generally observed very early, is to be regarded as reflex. The gradual coordination of ocular movements is the result of these reflex adjustments. It is probable that along with these reflexes there are developed spacial ideas. We can not observe the first beginnings of these ideas, but only their gradual development from very crude beginnings. This is due to the fact that the whole development is a gradual, continuous process, and is from the first interconnected with its original physiological substratum. Even in the child the sense of sight shows itself to be decidedly more rapid in its development than the sense of touch, for the symptoms of visual localization are certainly observable earlier than are those of tactual localization, and the grasping movements, as mentioned above, do not reach their full development until aided by the sense of sight. The field of *binocular* vision is much later in its development than that of monocular vision. Monocular localization shows itself in the discrimination of directions in space. The beginnings of the development of a field for binocular vision coincide with the first

coordination of ocular movements and belong, accordingly, to the second half of the first year. The perception of size, of distance, and of various three-dimensional figures, remains for a long time very imperfect. Especially, distant objects are all thought to be near at hand, so that they appear relatively small to the child. Devel. of Temporal Idea

4. *Temporal ideas* develop along with the spacial ideas. The ability to form regular temporal ideas and the pleasure derived by the child from these ideas, show themselves in the first months in the movements of his limbs and especially in the tendency to accompany rhythms that are heard, with similar rhythmical movements. Some children can imitate correctly, even before they can speak, the rhythmical melodies that they hear, in sounds and intonations. Still, the ideas of longer intervals are very imperfect, even at the end of the first year and later, so that a child gives very irregular judgments as to the duration of different periods and also as to the sequence of these periods. Assoc. & apper. combi

5. The development of *associations* and of *simple apperceptive combinations* goes hand in hand with the development of spacial and temporal ideas. Symptoms of sensible recognitions (p. 261) are observable from the very first days, in the rapidly acquired ability to find the mother's breast and in the obvious habituation to the objects and persons of the environment. Still, for a long time these associations cover only very short intervals of time, at first only hours, then days. Even in the third and fourth years children either forget entirely, or remember only imperfectly, persons who have been absent for a few weeks.

The case with *attention* is similar. At first it is possible to concentrate attention upon a single object only for a very short time, and it is obvious that *passive* apperception which always follows the predominating stimulus, that is, the stimulus which has the strongest affective tone (p. 238), is the only form of apperception present. In the first weeks, however, a lasting attention shows itself in the way in which the child fixates and follows objects for a longer time, especially if they are moving; and at the same time we observe the first trace of active apperception in the ability to turn voluntarily from one impression to another. From this point on, the ability becomes more and more fully developed; though the attention, even in later childhood, fatigues more rapidly than in adults, and requires a greater variety of objects or a more frequent pause for rest. Devel of Self-Co

6. The development of *self-consciousness* keeps pace with the development of the associations and apperceptions. In judging of this development we must guard against accepting as signs of self-consciousness single symptoms, such as the child's discrimination of the parts of his body from objects of his environment, his use of the word "I", or even the recognition of his own image in the mirror. The adult savage who has never before seen his own reflected image, takes it for some other person. The use of the personal pronoun is due to the child's imitation of the examples of those about him. This imitation comes at very different times in the cases of different children, even when their intellectual development in other respects is the same. Such use of the first personal pronoun is, to be sure, a symptom of the presence of self-consciousness, but the first beginnings of self-consciousness may have preceded this discrimination in speech by a longer or a shorter period of time in different cases. Again, the discrimination of the body and its parts from other objects is a symptom of exactly the same kind. The recognition of the body is a process that regularly precedes the true recognition of the image in the mirror, but one is as little a criterion of the beginning of self-con-

sciousness as the other. They both presuppose the existence of some degree of self-consciousness beforehand. Just as the developed self-consciousness is based upon a number of different conditions (p. 243), so in the same way, the self-consciousness of the child is from the first a product of several components, partly ideational in character, partly affective and volitional. Among the ideational processes, we have the discrimination of a *constant* group of ideas, among the affective and volitional processes, we have the development of certain interconnected processes of attention and certain volitional acts. The constant group of ideas does *not* necessarily include all parts of the body, as, for example, the legs, which are usually covered, and it may, as is more often the case, include external objects, as, for example, the clothes generally worn. The subjective affective and volitional components, and the relations that exist between these and the ideational components in external volitional acts, are the factors that exercise the greater influence. The influence of these subjective factors is shown most strikingly in the fact that strong feelings, especially those of pain, very often mark in an individual's memory the first moment to which the continuity of his self-consciousness reaches back. But there can be no doubt that a form of self-consciousness, even though less interconnected, exists even before this first clearly remembered moment, which generally comes in the third to the sixth year. Still, since the objective observation of the child is not based at first on any sure criteria, it is impossible to determine the exact moment when self-consciousness begins. Probably the traces of it begin to appear in the first weeks; after this it continually becomes clearer under the constant influence of the conditions mentioned, and increases in temporal extent just as does consciousness in general.

Devel of Will

7. The development of *will* is intimately connected with the development of self-consciousness. The development of will may be inferred partly from the development of attention described above, partly from the rise and gradual perfection of *external volitional acts.* The immediate relation of attention to will appears in the fact that symptoms of active attention and voluntary action come at exactly the same time. Very many animals execute immediately after birth fairly perfect impulsive movements. These are rendered possible by inherited reflex mechanisms of a complex character. The new-born child, on the contrary, does not show any traces of such impulsive acts. We observe, however, in the first days the earliest beginnings of simple volitional acts of an impulsive character. These result from the reflexes caused by sensations of hunger and by the sense perceptions connected with appeasing hunger. The primitive volitional acts growing out of these reflexes are to be seen in the evident quest after the sources of nourishment. With the obvious growth of attention come the volitional acts connected with impressions of sight and hearing: the child purposely, no longer merely in a reflex way, follows visual objects, and turns his head towards the noises that he hears. Much later come the movements of the outer muscles of the limbs and trunk. Especially the muscles of the limbs, show from the first lively movements, generally repeated time and time again. These movements are accompanied by all possible feelings and emotions, and when the emotions become differentiated, the movements begin gradually to exhibit certain differences characteristic of the quality of the emotions. The chief difference consists in the fact that rhythmical movements accompany pleasurable emotions, while arhythmical, and, as a rule, violent movements result when the emotions are unpleasurable. These expressive move-

ments, which must be looked upon as reflexes attended by feelings pass, as occasion offers, and as soon as the attention begins to turn upon the surroundings, into ordinary *voluntary* expressive movements. Thus, the child shows through the different accompanying symptoms that he not only feels pain, annoyance, anger, etc., but also that he wishes to give expression to these emotions. The first movements, however, in which an antecedent motive is to be recognized beyond a doubt, are the *grasping movements* which begin in the twelfth to the fourteenth week. At first, the foot takes part in these movements as well as the hand. We have here also the first clear symptoms of sense perception, as well as the first indications of the existence of a simple volitional process made up of motive, decision, and act. Somewhat later intentional imitative movements are to be observed. Simple mimetic imitations, such as puckering the lips and frowning, come first, and then pantomimetic, such as doubling up the fist, beating time, etc. Very gradually, as a rule not until after the beginning of the second half of the first year, *complex* volitional acts develop from these simple ones. The oscillation of decision, the voluntary suppression of an intended act or one already begun, are clearly observed at this period.

Learning to walk, which usually begins in the last third of the first year, is an important factor in the development of voluntary acts in the proper sense of the term. The importance of this development is due to the fact that walking to certain particular places furnishes the occasion for the rise of a number of conflicting motives. Learning to walk is itself to be regarded as a process in which the development of the will and the effect of inherited dispositions to certain particular combinations of movements are continually interacting upon each other. The first impulse for the movement comes from volitional motives; the purposive way in which the act is carried out, however, is primarily an effect of the central mechanism of coordination, which in turn is rendered continually more and more purposive as a result of the individual's practice directed by his will.

Develop of Speech

8. The development of the child's *ability to speak* follows that of his other volitional acts. This, too, depends on the one hand, on the cooperation of inherited modifications in the central organ of the nervous system and depends on the other hand, on outside influences. The most important outside influences in this case are those that come from the speech of those about the child. In this respect the development of speech corresponds entirely with the development of the other expressive movements, among which it is, from its general psycho-physical character, to be classed. The earliest articulations of the vocal organs appear as early as the second month, as reflex phenomena, especially accompanying pleasurable feelings and emotions. After that they increase in variety and exhibit more and more the tendency to repetition (for example, ba-ba-ba, da-da-da-da, etc.). These expressive sounds differ from those of many animals only in their greater number and continually changing variety. They are produced on all possible occasions and without any intention of communicating anything, so that they are by no means to be classed as elements of speech. Through the influence of those about the child these sounds generally become elements of speech after the beginning of the second year. This result is brought about chiefly by certain imitative movements. The imitation here involved is a two-fold imitation of sounds. On the one hand, the child imitates adults, on the other, adults imitate the child. In fact, as a rule, it is the adults who begin the imitating; they repeat

the involuntary articulations of the child and attach a particular meaning to them, as, for example, "pa-pa" for father, "ma-ma", for mother, etc. It is not until later, after the child has learned to use these sounds in a particular sense through intentional imitation, that he repeats other words of the adults' language also, and even then he modifies these borrowed words to fit the stock of sounds that he is able to articulate.

Gestures are important as means by which adults, more instinctively than voluntarily, help the child to understand the words they use. Gestures are generally indicative gestures or gestures towards the objects; less frequently, and ordinarily only in the case of words meaning some activity such as strike, cut, walk, sleep, etc., the gestures take the form of representative gestures. The child has a natural understanding of the meaning of these gestures, while he has no such understanding of the meaning of words. Even the onomatopoetic words of child speech (such as bow-wow for dog, etc.) never become intelligible to the child until the objects have been frequently pointed out. The creator of these onomatopoetic words is not the child, it is rather the adult, who seeks instinctively to accommodate himself to the stage of the child's consciousness in this respect as well as in others.

All this goes to show that the child's learning to speak is the result of a series of associations and apperceptions in the formation of which associations and apperceptions both the child and those about him take part. Mother or nurse voluntarily designates particular ideas by using certain words taken from the expressive sounds produced by the child, or by using onomatopoetic words made arbitrarily after the pattern of the first class. The child apperceives this combination of word and idea after it has been made intelligible to him by means of gestures and he then associates the idea with his own imitative articulative movements. Following the pattern of these first apperceptions and associations the child now forms others, by imitating of his own accord more and more the words and verbal combinations that he accidentally hears adults using, and by making the appropriate associations with their meanings. The whole process is thus the result of a psychical interaction between the child and those about him. The sounds are at first produced by the child alone, those about him take up these sounds and make use of them for purposes of speech. Celerity of Childs Im

9. As a result of all the simpler processes of development thus far discussed there arise the *complex functions of apperception*, that is, the relating and comparing activities, and the activities of imagination and understanding which are made up of relating and comparing processes (§ 17).

Apperceptive combinations appear at first exclusively in the form of *imagination*, that is, in the combination, analysis, and relating of concrete sensible ideas. Thus, individual development corroborates what has been said in general about the genetic relation of these functions (p. 278). On the basis of the continually increasing association of immediate impressions with earlier ideas, there arises in the child, as soon as his active attention is aroused, a tendency to form imaginative combinations voluntarily. The number of memory elements freely combining with the impression and added to it, furnishes us with a measure of the fertility of the individual child's imagination. As soon as this combining activity of imagination has once begun to operate, it shows itself with an impulsive force which the child is unable to resist, for there is not as yet, as in the case of adults, any activity of the understanding to prescribe definite intellectual ends regulating and inhibiting the free sweep of the ideas of imagination.

Play Impu

This unchecked relating and coupling of ideas in imagination is connected with volitional impulses which aim to find for the ideas some starting points in immediate sense perception, however vague these starting points may be. This is what gives rise to the child's *play impulse*. The earliest games of the child are those of pure imagination; while, on the contrary, the games of adults (cards, chess, lotto, etc.) are almost as exclusively intellectual games. Only where aesthetical demands exert an influence, are the games of adults the productions of the imagination (drama, piano playing, etc.), but even here they are not wholly untrammeled like those of the child, but are regulated by the understanding. When the play of a child takes its natural course, it shows at different periods of its development all the intermediate stages between the game of pure imagination and the game in which imagination and understanding are united. In the first years play consists in the production of rhythmical movements of the arms and legs, then the movements are carried over to external objects as well, with preference for such objects as give rise to auditory sensations, or such as have bright colors. In their origin these movements are obviously impulsive acts aroused by certain sensational stimuli and dependent for their purposive coordination on inherited traits of the central nervous organs. The rhythmical order of the movements and of the feelings and sound impressions that result from them, obviously arouse pleasurable feelings, and the arousal of such feelings very soon results in the voluntary repetition of the movements. After this, during the first years, play becomes gradually a voluntary imitation of the occupations and scenes that the child sees about him. The range of imitation then widens and is no longer limited to what is seen, but includes a free reproduction of what is heard in narratives. At the same time the interconnection between ideas and acts begins to follow a more fixed plan. This indicates the regulative influence of the activity of understanding, which shows itself in the games of later childhood in prescribed rules. This development of games is often accelerated through the influence of those about the child and through artificial forms of play generally invented by adults and not always suited to the child's imagination. In all cases, however, this development is to be recognized as natural, and conditioned by the reciprocal interconnection of associative and apperceptive processes, since such a course of development corresponds with the general development of the intellectual functions. The way in which the processes of imagination are gradually curtailed and the functions of understanding more and more employed, renders it probable that the curtailing is due, not so much to a quantitative decrease of imagination, as to an obstruction of imagination through abstract thinking. When this process of obstruction has once set in, the activity of imagination may itself through lack of use, and because of the greater exercise of abstract thought, begin to decrease. This view seems to be supported by the fact that savages usually have all through their lives an imaginative play impulse related to that of the child.

10. From these primitive imaginative forms of thought the *functions of understanding* develop very gradually in the way already described (p. 294). Aggregate ideas which are presented in sense perception or are formed by the combining activity of imagination are divided into their *conceptual* components, that is, into objects and their attributes, into objects and their activities, or into the relations of different objects to one another. The decisive symptom of the rise of the functions of understanding is therefore the formation

of *concepts*. On the other hand, actions that can be explained from the point of view of the observer by logical reflection, are by no means proofs of the existence of such reflection on the part of the actor, for such actions are very often obviously derived from associations, just as in the case of animals. In the same way there may be the first beginnings of speech without abstract thinking in any proper sense, since words refer originally only to concrete sensible impressions. Still, the more perfect use of language is not possible until ideas are conceptually analyzed, related, and transferred, even though the processes are in each case entirely concrete and sensible. The development of the functions of understanding and the development of speech, accordingly, go hand in hand, and the latter is an indispensable aid in retaining concepts and fixing the operations of thought.

Mistakes in Child Psych.

10a. Child psychology often suffers from the same mistake that is made in animal psychology, namely, from the mistake of not interpreting observations objectively. The observations are filled out with subjective reflections. Thus, the earliest ideational combinations, which are in reality purely associative, are regarded as acts of logical reflection, and the earliest mimetic expressive movements, as, for example, those of a new-born child due to taste stimuli, are looked upon as reactions to feelings, while they are obviously at first nothing but connate reflexes. These reflexes may, it is true, be accompanied by obscure concomitant feelings, but certainly such feelings can not be demonstrated with certainty. The ordinary view as to the development of volition and of speech, labors under a like misconception. Generally there is a tendency to consider the child's language, because of its peculiarities, as a creation of his own. Closer observation, however, shows that it is created by those about him, though in doing this adults use the sounds that the child himself produces, and conform as far as possible to the child's stage of consciousness. Thus it comes that some of the very detailed and praise-worthy accounts of the mental development of the child in modern literature can serve merely as sources for objective facts. Their psychological deductions require correction along the lines marked out above, because they stand on the basis of reflective popular psychology. The efforts which have frequently been made to employ *experimental* methods in the investigations of child psychology have attained a degree of success only when these methods have been used with children of fairly advanced age, for example, with school children. When thus applied, experiments have produced results which have pedagogical as well as psychological value. Such are the results in regard to the course and duration of attention, the relation between bodily fatigue and mental fatigue, etc. During the earlier periods of the child's life experimental methods are hardly applicable at all. The results of experiments which have been tried on very young children must be regarded as purely chance results, wholly untrustworthy on account of the great number of sources of error. For these reasons it is an error to hold, as is sometimes held, that the mental life of adults can never be fully understood except through the analysis of the child's mind. The exact opposite is the true position to take. Since in the investigation of children and of savages, only objective symptoms are in general available, any psychological interpretation of these symptoms is possible only on the basis of mature adult introspection which has been carried out under experimental conditions. For the same reasons, it is only the results of observations of children and savages which have been subjected to a similar psychological analysis, which furnish any proper basis for conclusions in regard to the nature of mental development in general.

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§ 21. DEVELOPMENT OF MENTAL COMMUNITIES.

Dif. between human and animal commun

1. Just as the psychical development of the child is the resultant of his interaction with his environment, so matured consciousness stands continually in relation to the mental community in which it has a receptive and an active part. Among most animals such a community is entirely wanting. Animal marriage, animal states, and flocks, are only incomplete forerunners of mental communities, and they are generally limited to the attainment of certain single ends. The more lasting forms, that is animal marriage and the falsely named animal states (p. 311), are really sexual communities; the more transient forms such as flocks, for example flocks of migratory birds, are communities for protection. In all these cases it is certain instincts that have grown more and more fixed through transmission, which hold the individuals together. The community, therefore, shows the same constancy as do instincts, and such a community is very little modified by the influences of individuals.

While animal communities are, thus, mere enlargements of the individual existence, aiming at certain physical vital ends, *human* development seeks, from the first, so to unite the individual with his mental environment that the whole community is capable of development, serving at once the satisfaction of the physical needs of life and the pursuit of the most various mental ends, while permitting at the same time great variations in these ends. As a result, the forms of human society are exceedingly variable. The more fully developed forms, however, enter into a continuous train of *historical* development which extends the mental ties connecting individuals further and further beyond the bounds of immediate spacial and temporal proximity. The final result of this development is the formation of the notion of *humanity* as a great general mental community which is divided up according to the special conditions of life into single concrete communities, peoples, states, civilized societies of various kinds, races, and families. The mental community to which the individual belongs is, therefore, not merely a single union, it is rather a changing group of mental unions which are all interlaced in the most manifold ways and which become more and more numerous as development progresses. Product of Human commun

2. The problem of tracing these developments in their concrete forms or even in their general interconnection, belongs to the history of civilization and to general history, not to psychology. Still, we must give some account here of the general psychical conditions of community life and the psychical processes arising from these conditions, which processes distinguish social from individual life.

The condition which is a prime necessity of every mental community at its beginning, and a continually operative factor in its further development, is the *function of speech*. This is what makes the development of mental communities from individual existences psychologically possible. In its origin speech comes from the expressive movements of the individual, but as a result of its development it becomes the indispensable form for all common mental contents. These common contents, or the mental processes which belong to the whole community, may be divided into *two* classes, which are merely interrelated components of social life, not distinct processes, any more than the processes of ideation and volition are distinct in individual experience. The first of these classes of common contents is the class of the *common ideas*. In this class we find especially the common feelings and emotions a of fear and hope — these are the *mythological ideas*. The second class consists of the *common motives of volition*, 2 which correspond to the common ideas and their attending feelings and emotions — these are the *laws of custom*.

A. SPEECH.

Gesture Lang

3. We obtain no information in regard to the *general development of speech* from the individual development of the child, because in the case of the child the larger part of the process depends on those about him rather than on the child himself (p. 324 sq.). Still, the fact that the child learns to speak at all, shows that he has psychical and physical traits favorable to the reception of language when it is communicated. In fact, it may be assumed that these traits would, even if there were no communications from without, lead to the development of some kind of expressive movements accompanied by sounds, which sounds would form an incomplete language. This supposition is justified by the observation of the deaf and dumb, especially deaf and dumb children who have grown up without any systematic education. In spite of this lack of education, an energetic mental intercourse may take place between them. In such cases, however, since the deaf and dumb can perceive only *visual* signs, the intercourse must depend on the development of a natural *gesture language* made up of a combination of significant expressive movements. Feelings are in general expressed by mimetic movements, ideas by pantomimetic movements, either by pointing at the object with the finger or by drawing some kind of picture of the idea in the air, that is, by means of indicative or representative gestures (p. 109). There may even be a combination of such signs with each other, thus leading to a kind of sentence structure by means of which wishes and questions are expressed, things are

described, and occurrences narrated. This natural gesture language can never go any further, however, than the communication of concrete sensible ideas and their interconnections. Signs for abstract concepts are entirely wanting.

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4. The primitive development of *articulate* language can hardly be thought of except after the analogy of the rise of this natural gesture language. The only difference is that in this case the ability to hear, results in the addition of a third form of movements to the mimetic and pantomimetic movements. This third form consists in the articulatory movements, and since such articulatory movements are much more easily perceived, and capable of incomparably more various modifications, it must of necessity follow that they soon exceed the others in importance. But just as gestures owe their intelligibility to the immediate relation that exists between the character of the movement and its meaning, so here also we must presuppose a like relation between the original articulatory movement and its meaning. Then, too, it is not improbable that articulation was at first aided by accompanying mimetic and pantomimetic movements. Evidence in support of this view is to be found in the unrestrained use of such gestures by savages, and in the important part which gestures play in the child's learning to speak. The development of articulate language is, accordingly, in all probability to be thought of as a process of differentiation, in which the articulatory movements have gradually gained the permanent ascendency over a number of different variable expressive movements which originally attended them. The articulation movements have, then, dispensed with these auxiliary movements as they themselves gained a sufficient degree of fixity. Psychologically the process may be divided into *two* acts. The first consists in the expressive movements of the individual member of the community. These

are impulsive volitional acts, among which the movements of the vocal organs gain the ascendency over the others in the effort of the individual to communicate with his fellows. The second consists in the subsequent associations between sound and idea, which gradually become more fixed, and spread from the localities where they originated through wider circles of society.

Changes in sounds & mean

5. From the first there are other physical and psychical conditions which take part in the formation of language and produce continual and unceasing modifications in its components. Such modifications may be divided into two classes, namely, *modifications of sound* and *modifications of meaning*.

Modifications of sound have their physiological cause in the gradual changes that take place in the physical structure of the vocal organs. These changes seem to come partly from the general changes which the transition from a savage to a civilized condition produces in the whole psycho-physical organism, and partly from the special conditions which result from increased practice in the execution of articulatory movements. Many phenomena go to show that the gradually increasing rapidity of articulation is one of the facts of practice which is of especially great influence. Then, too, the words that are in any way analogous, act upon one another in a way which gives evidence of the direct psychological influence of association, especially of association between verbal ideas which are in any way related, either through sound only, or through likenesses in both sound and meaning (so-called analogous word constructions).

As the change in sound modifies the outer form of words, so the change in meaning modifies the inner content. The original association between a word and the idea it expresses is modified by the substitution of another, different idea.

This process of substitution may be several times repeated with the same word. The change in the meaning of words depends, therefore, on a gradual modification of the associative and apperceptive conditions which determine the ideational complications that shall arise in the fixation-point of consciousness when a word is heard or spoken. It may, accordingly, be briefly defined as a shifting of the ideational component of the complications connected with articulate sounds (p. 259). It is due at times to association, at times to apperception.

These changes in the sound and meaning of words operate together in bringing about the gradual disappearance of the originally necessary relation between sound and meaning, so that a word finally comes to be looked upon as a mere external sign of the idea. This process is so complete that even those verbal forms in which this relation seems to be still retained, that is, in the case of onomatopoetic words, we must recognize the forms themselves as for the most part relatively late products of a secondary assimilative process, which process seeks to reestablish the originally present, but now lost, affinity between sound and meaning.

Another important consequence of this combined action of changes in sound and meaning, is to be found in the fact that many words gradually lose entirely their original concrete sensible significance, and become signs of general concepts and means for the expression of the apperceptive relating and comparing functions and their products. In this way *abstract thinking* is developed. Such abstract thinking would be impossible without the change in meaning of words upon which it is based, and it is, therefore, a product of the psychical and psycho-physical interactions on which the progressive development of language depends.

Psych significance of the order of words.

6. Just as the components of language, or words, are undergoing a continual modification in sound and meaning, so in the same way, though generally more slowly, changes are going on in the combinations of words into larger wholes that is, in *sentences*. No language can be thought of without some such syntactic order of its words. Sentences and words are, therefore, equally essential forms of thought. Indeed, the sentence is the earlier of the two, for the thought appears at first as a single whole and is later broken up into its components (p. 291). In the more incomplete stages of language the words of a sentence are, accordingly, only very uncertainly distinguished from each other. There is no universal rule even for the order of words, any more than there is for the relation of sound to meaning. The order that logic favors with a view to the relations of reciprocal logical dependence between concepts, has no psychological universality; it appears, in fact, to be a fairly late product of development, due in part to arbitrary convention, and approached only by the prose forms of some modern languages which are syntactically nearly fixed. The original principle followed in apperceptive combination of words is obviously this, *the order of the words corresponds to the succession of ideas*. As a result those parts of speech that arouse the feelings and attract the attention most intensely are placed first. Following this principle, certain regularities in the order of words are developed in any given community. In fact, such a regularity is to be observed even in the natural gesture language of the deaf and dumb. Still, it is easy to understand that the most various modifications in this respect may appear under special circumstances. In general, however, the habits of association lead more and more to the fixing of particular syntactic forms, so that gradually a certain regularity begins to assert itself through a kind of

associative attraction exerted by the forms most commonly employed.

Apart from the general laws presented in the discussion of apperceptive combinations, and there shown to arise from the general psychical functions of relating and comparing (p. 278), the detailed discussion of the characteristics of syntactic combinations and their gradual changes, must be left, in spite of their psychological importance, to social psychology, because such syntactic combinations depend so much on the specific dispositions and conditions of civilization in a given community.

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B. MYTHS.

Personify. apperception

7. The fundamental function which in its various forms of activity gives rise to all mythological ideas, is a characteristic kind of apperception belonging to all naive consciousness and suitably designated by the name *personifying* apperception. It consists in the complete determination of the apperceived objects through the nature of the perceiving subject. The subject not only finds his own sensations, emotions, and voluntary movements reproduced in the objects, but even his momentary affective state is in each case especially influential in determining his view of the phenomena perceived, and in arousing ideas of the relations of these phenomena to his own existence. As a necessary result of such a view the *personal* attributes which the subject finds in himself are assigned to the object. The *inner* attributes, of feeling, emotion, etc., are never omitted. The *outer* attributes of voluntary action and other expressions like those of men, are generally as-

signed to objects only when there are actually perceived movements. Thus, the savage may attribute to stones, plants, and works of art, an inner capacity for sensations and feelings and for the resulting effects of these processes, but he usually assumes immediate action only in the case of moving objects, such as clouds, heavenly bodies, winds, etc. In all these cases the personification is favored by associative assimilations which readily reach the intensity of illusions of fancy (p. 299). Gen. Cond. for its develop.

8. Myth-making, or personifying, apperception is not to be regarded as a special form or even as a distinct sub-form of apperception. It is nothing but the natural inceptive stage of apperception in general. The child shows obvious traces of it, partly in the activities of his imagination in play (p. 251), partly in the fact that strong emotions, especially fear and fright, easily arouse illusions of fancy with an affective character analogous to that of the emotion. In the case of children, however, the manifestations of a tendency to form myths are early checked and soon entirely suppressed through the influences of environment and education. With savage, and partly civilized peoples it is different. There the surrounding influences present a whole mass of mythological ideas to the individual consciousness. These, too, originated in the minds of individuals, and have gradually become fixed in some particular community, and through language have been transmitted from generation to generation and become gradually modified in the transition from savage to civilized conditions. Animism & fetishism

9. The direction in which these modifications take place, is determined in general by the fact that the momentary affective state of the subject is the chief influence in settling the character of the myth-making apperception. In order to gain some notion of the way in which the affective state

of the subject has changed from the first beginnings of mental development to the present, we must appeal to the history of the development of mythological ideas, for other evidences are entirely wanting. It appears that in all cases the earliest mythological ideas referred to the personal fate in the immediate future, and were determined, by the emotions aroused by the death of comrades and by the memory of these comrades, and were also determined in a high degree by the memories of dreams. This is the source of so-called "animism", that is, all those forms of belief in which both the spirits of the dead and certain demons connected with certain objects, places or practical occupations (demons of the woods and fields, of agriculture and navigation) are thought of as taking the parts of rulers of fortune and as bringing either weal or woe into human life. "Fetishism" is a branch of animism, in which the attribute of ability to control fate is carried over to certain objects in the environment, such as plants, stones, works of art, especially objects which arouse the feelings on account of their striking character or on account of some accidental outer circumstance. The phenomena of animism and fetishism are not only the earliest, but also the most lasting, productions of myth-making apperception. They continue, even after all others are suppressed, in the various forms of superstitions among civilized peoples, such as belief in ghosts, enchantments, charms, etc. Myth Nature

10. After consciousness reaches a more advanced stage, personifying apperception begins to deal with the greater natural phenomena which act upon human life both through their changes and through their direct influence, that is, with the clouds, rivers, winds, and greater heavenly bodies. The regularity of certain natural phenomena, such as the alternation of night and day, of winter and summer, the processes

in a thunderstorm, etc., gives occasion for the formation of poetical myths, in which a series of interconnected ideas are woven into one united whole. In this way the *nature myth* arises. The chief difference between nature myths and the earlier forms of belief in spirits and demons consists in the fact that nature myths deal with *personal gods*. These various gods are given a great variety of characteristics, and are gradually freed from any special connection with definite places, times, or activities. They come to be nothing more nor less than anthropomorphic personalities with superhuman power. They are worshiped as the governors of natural phenomena as well as human destinies. As the result of this development of more comprehensive ideas of the gods, the demons and minor deities gradually sink into the background, or else they are so united with the ideas of the gods themselves that they come to be regarded as attributes of the deities or as special forms in which the gods appear. The process of combination and fusion of these ideas and feelings usually goes a step further than the creation of a number of personal gods. Some single one of these deities, at first in an irregular and doubtful way, and then much more permanently, becomes superior to all the others. Thus a strong monotheistic tendency shows itself from a very early period in the nature myth, which is essentially polytheistic in character. On the other hand, a tendency in the opposite direction, namely, in the direction of breaking up the ideas of the gods into a great number of personalities, may result from a fusion of the ideas of the gods with those of the earlier special deities and demons. In this way there arise certain local deities and tribal deities. These deities can then, because of their personal character, easily be disassociated from the special conditions which gave rise to them, and they then become the bases for the various forms of *hero myths*.

Traces of historical truth get themselves grafted into these personal myths or hero myths, and thus the tendency to make the deities more and more like men, which tendency showed itself to some extent even in the nature myth, goes even further. The hero myths thus challenge the poetical genius of the individual to its highest efforts and these myths become components of popular, and then of literary poetry. At the same time, however, the hero myth undergoes a change in meaning through the fading out of some of the features of the single mythical figures and the appearance of other new features. This change, in turn, makes possible a progressive inner change analogous to the change in words, by which the change in the myth is always accompanied. As the process goes on, single poets and thinkers gain an increasing influence.

In this way there comes about finally, a division of the total original content of the myths into science and religion. This division is very materially assisted by philosophy which in its first stages is more than half mythical in its ideas. The original ideas of gods and heroes now give place more and more to *ethical* ideas of deity. This transition is in part due to the reflex influence of philosophy on religion. As in the case of the nature myth, so even at the later stage of developed ethical religion, there are tendencies to lapse back into the older forms because the old motives for the creation of these early forms still continue. Special deities, demons, and spirits push themselves into the foreground of consciousness, sometimes for longer periods of time, sometimes merely for the passing moment. Such revived beliefs sometimes constitute a sort of secondary addition or supplement to religion itself, sometimes when positively rejected by religion they continue to exist independently in the form of superstitions.

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C. CUSTOMS.

Indiv. & social laws of custom

11. Customs appear as far back as we can trace them in two *groups* which may be described by the twofold classification into rules of 1 *individual* volition, and rules of 2 *social* conduct. 1 The first govern the conduct of the individual in his occupations and in his relations with others, the second determine the forms of community life in the clan, family, state, or other social group. Both individual and social laws of custom are, therefore, connected with community life. The former relate to the conduct of the *individual* in the community, the latter relate to the members of the community in their *common activities*, in the activities which determine the particular character of their life together.

The *individual* rules of conduct which have become customs are generally connected in their beginnings, which are indeed frequently obscure, with myths in a way corresponding directly to that in which outer volitional acts are related to inner motives. Wherever we can trace the origin of such customs with any degree of probability, we find that they are remnants or modifications of certain *cult forms*. Thus, the funeral feasts and burial ceremonies of civilized peoples point to a primitive ancestor-worship. Numerous feasts and ceremonies connected with particular days, with the change of the seasons, the tillage of the fields, and the gathering of the harvest, all point back to certain demon cults, and nature myths. The custom of greeting, in its various forms, betrays its direct derivation from the ceremonies of prayer.

In contrast with these demands on individual practice,

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there are certain necessary demands arising out of the conditions of community life, and out of the particular ways in which the impulses of self preservation and tribal preservation show themselves; and as a result of these *necessary demands,* there grow up *social* laws of custom. Thus, it was the surrounding conditions under which a primitive people lived which determined the method of making clothing and dwellings, the mode of preparing food, and the particular forms of subdividing the community. Even the changes which have taken place in all these respects as the people have slowly passed from a savage to a civilized state, have all taken place in response to the requirements of practical advantage. Especially notable illustrations of this are to be found in the earliest kinds of community life and in the wider and narrower social units that have grown out of these early forms. Thus, the tribe in which men everywhere lived at first, was divided into smaller groups or subtribes under the force of external conditions of life, and because of the increase in the number of individuals in the tribe. The smaller groups or subtribes usually continued organized after their separation from each other in a general protective league which gave the impulse for the formation of general families through the intercourse of individuals of different tribes. From these general families in turn, there arose, as civilization progressed, the single family. The tribe itself gradually underwent a change in character during this process of subdivision. As the interrelations between individuals, which arose at first out of temporary causes, began to be reduced to permanent rules, the tribe passed immediately into the first stages of state organization by becoming a *confederation of tribes.* From this confederation arose in much later times *political* states. These are usually the results of war alliances and represent therefore the divisions natural in war.

Changes in meaning of custom. Differ
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12. With customs, as with language and myths, the *change in meaning* has exercised a modifying influence on development. In *individual* customs there arise as a result of this change in meaning *two* chief kinds of transformation. In the first, the original mythical motive is lost and no new meaning whatever takes its place. The custom continues merely as a consequence of associative habit, but loses its imperative character and becomes much weaker in its outward manifestations. In the second class of transformations, a *moral-social* purpose takes the place of the original mytho-religious motive. The two kinds of change may in any single case be most intimately united; and even when a custom does not serve any particular social end directly, as is the case, for example, with certain rules of deportment, of etiquette, on the manner of dressing, eating, etc., still, the custom may serve some social end indirectly in that the existence of some common rules for the members of a community is favorable to their united life and therefore to their common mental social life.

In *social* customs the change is in a direction opposite to that seen in individual customs. Social customs usually retain, more than individual customs, the old significance along with the new they acquire. The transformation of social customs thus consists always in an *enlargement* of the significance so that as a rule religio-mythical motives are sooner or later added to the original motives which are the necessities of social life. Thus, the rules of action which at first grew up as the result of certain necessary impulses, come to be regarded as commands of the gods, or they are rendered sacred by some kind of religious ceremonial. For example, the common meals, the erection of common dwelling places, agreements and confederations, declarations of war and treaties of peace and marriage, are all combined with certain mythical concepts or else they arouse the myth-making apperception to such an extent that new deities are created especially for the governing of these social customs. Finally, it is to be noted that the mythical notions which have attached to social customs may in time fade out. There then takes place a kind of retransformation in which the religious element of the custom either disappears, or remains merely as a formality due to habit and unsupported by recognized significance.

The psychological changes in customs just pointed out, constitute the preparation for their differentiation into *three* spheres, namely into the classes of *pure custom*, of *law*, and of *morality*. The last two are to be regarded as special forms of custom aiming at certain social ends. The detailed investigation of these processes of development and differentiation is, however, a problem of social psychology, and the discussion of the rise of law and morality belong both to social psychology, and to general history, and ethics.

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D. GENERAL CHARACTER OF THE DEVELOPMENTS STUDIED IN SOCIAL PSYCHOLOGY.

Condensation - Recurring of complexity of Ideas

13. Speech, myths and customs constitute a series of closely related subjects which are of great importance to general psychology for the reason that the relatively permanent character of speech, myths, and customs renders it relatively easy to recognize clearly through them certain general psychical processes, and to carry out through them

certain psychological analyses. Such recognition of general processes and such analyses are much easier here than in the case of transient compounds of individual consciousness. Indeed, such transient compounds require as their necessary conditions preliminary social developments, especially if compounds are in any way connected with language and therefore dependent upon the laws of social thought which have been crystalized in language. Thus, it was necessary in an earlier paragraph, when treating of the processes of apperceptive synthesis and analysis, to call attention to the effects of these processes as they appear in speech (p. 290). Just as the psychical processes of individual consciousness show themselves in language as there indicated, so also in the case of broader social developments, the psychical processes which underlie the observed phenomena are most clearly recognizable in the attributes and modifications of the *ideas* which are expressed in speech. The accompanying processes of affective excitation can be inferred only indirectly through an examination of the total series of facts and with the aid of certain known conditions.

There are certain processes which are essential in character and are constantly reappearing on the ideational side in all development of language, custom and myths. We may point out three such processes which are closely related to each other. They may be called respectively, *condensation* of ideas, *obscuring* of ideas, and finally, *corruption* of ideas. Ideas become condensed when a number of ideas which were originally separate are, in consequence of repeated and strongly affective association, so united that they come to be bound together in apperception in a single whole. But since certain elements in the course of such a process of condensation are more clearly apperceived because of their more intense affective influence, it follows that other elements not strong in affective tone sink into obscurity and may at length disappear entirely out of the complex product. In this way, a corruption of the ideas may finally take place which will give as its final stage, especially when condensation and obscuring have been repeated several times, and have effected different components each time, a product which is entirely different from the original ideas with which the processes started. Condensation, obscuring and corruption in their various forms are what bring about all the changes in the meaning of words and all the transformations in myths and customs. When either a word, a myth, or a custom, has been modified, the others may be indirectly affected also. Thus, when a word changes, it is very easy for the mythological ideas connected with it to undergo a modification. The change in the myth may then react upon the word. It is possible in cases in which other conditions are favorable, for words to give rise directly to mythological ideas which put content into the word furnished by language. On the other hand, the existence of a myth may lead to the formation of a name or word to fit.

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Throughout all these general social processes, it is the idea which is first noticed. Psychological analysis shows, however, that it is after all the affective processes and the volitional processes which are the determining factors in the original formation of the ideas and in their gradual transformation. Thus, we can think of the original incoherent sounds which must be recognized as the beginnings of speech only as simple impulsive actions which follow directly upon the reception of a strongly affective impression and which serve in some way to communicate this impression to the listener. The communication may be through the sound alone, or through the aid of added gestures (p. 333). When the development of social thought has once begun, the mythological ideas show beyond a doubt traces of the influences of the feelings. Personifying apperception which shows itself in the myth differs from more highly developed consciousness in one characteristic more than in any other. In personifying apperception the subject refers not merely the formal attributes and the sensation content of the percept to the object, but he refers also his whole affective and volitional state to the object. For example, a hopeful subject finds in the object before him a protecting spirit, while the fearful subject finds in the same object a demon of injury. In the processes of nature, the savage sees a will which corresponds to his association of these processes with his own actions and corresponds also to the effect produced on his feelings. Even the three processes of condensing, obscuring and corrupting of ideas are to be looked upon as indications of changes in the affective state of the subject. These changes in affective state result at first in a change in the significance of myth and custom and then secondarily they react upon language also. Collective Consc. & Collective Will

14. In mental communities and especially in their development of language, myths and customs, we discover, thus, mental interconnections and interactions which differ in essential respects from the interconnection of the psychical compounds in an individual consciousness. And yet these social interconnections have just as much *reality* as the individual consciousness itself. In this sense we may speak of the interconnection of the ideas and feelings of a social community as a *collective consciousness*, and of the common volitional tendencies as a *collective will*. In doing this we are not to forget that these concepts do not mean something that exists apart from the conscious and volitional processes of the individual, any more than the community tself is something besides the union of individuals. Sincei

the social union, however, brings forth certain mental products, for which only the germs are present in the individual, and since this union determines the development of the individual from a very early period, it is just as much an object of psychological study as is the individual consciousness. For psychology must give an account of the interactions which give rise to the products and attributes of collective consciousness and of the collective will.

Critical Remarks

14a. The facts arising from the existence of mental communities have only recently come within the pale of psychological investigation. These problems were formerly referred either to the special mental sciences (philology, history, jurisprudence, etc.) or, if of a more general character, to philosophy, that is, to metaphysics. If psychology did touch upon them at all, it was dominated, as were the special sciences, by the reflective method of popular psychology, which method tends to treat all mental products of communities, to as great an extent as possible, as voluntary inventions designed from the first for certain utilitarian ends. This view found its chief philosophical expression in the doctrine of a social contract, according to which a mental community is not something original and natural, but is derived from the voluntary union of a number of individuals. This position is psychologically untenable, and completely helpless in the presence of the problems of social psychology. As one of its after-effects we have even to-day the grossest misunderstandings of the concepts collective consciousness and collective will. Instead of regarding these simply as expressions for the actual agreement and interaction of individuals in a community, some continue to suspect that there is behind these terms a mythological being of some kind, or at least a metaphysical substance. That such notions are utterly false requires no further proof after what has been said. It is obvious that these notions are themselves the results of the unjustifiable use of the concept substance, which concept has so long dominated psychology and led to the identification of substance and reality. Furthermore, the confusion of the concepts substance and reality shows clearly how close is the true inner relation between popular spiritualism and materialism although such spiritualism is openly at war with materialism (compare § 2, p. 7).

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V. PSYCHICAL CAUSALITY AND ITS LAWS.

§ 22. CONCEPT OF MIND.

1. Every empirical science has, as its primary subject of treatment, certain particular facts of experience the nature and reciprocal relations of which it seeks to investigate. In dealing with such facts it is found to be necessary, if science is not to give up entirely the grouping of the facts under leading heads, to have *general supplementary concepts* which are not contained in experience itself, but are gained by a process of logical treatment of experience. The most general supplementary concept of this kind which has found its place in all the empirical sciences, is the concept of *causality*. It comes from the necessity of thought which prescribes that all our experiences shall be arranged according to reason and consequent, and that we shall remove, by means of *secondary* supplementary concepts and if need be by means of concepts of a hypothetical character, all contradictions standing in the way of the establishment of a consistent interconnection of experience in accordance with the principle of reason and consequent. In this sense we may regard all the supplementary concepts that serve for the interpretation of any sphere of experience, as applications of the general principle of causation. These concepts are legitimate in so far as they are required, or at least rendered probable, by

the causal principle; they are unwarranted as soon as they prove to be arbitrary fictions resulting from foreign motives, and contributing nothing to the interpretation of experience.

2. The concept *matter* is a fundamental supplementary concept of natural science formulated under the principle stated. In its most general significance matter designates the permanent substratum assumed as existing in universal space, that is, the substratum of the activities to which we must attribute all natural phenomena. In this most general sense the concept matter is indispensable to every explanation of natural science. The attempt in recent times to raise *energy* to the position of a governing principle, does not succeed in doing away with the concept matter, but merely gives it a different content. This content, however, is given to the concept by means of a second supplementary concept, which relates to the *causal activity* of matter. The concept of matter that has been accepted in natural science up to the present time, is based upon the mechanical physics of Galileo, and uses as its secondary supplementary concept the concept of *force*, which is defined as the product of the mass and the momentary acceleration. A physics of energy seeks to introduce everywhere instead of this concept force, the concept *energy*, which in the special form of mechanical energy is defined as half the product of the mass multiplied by the square of the velocity. Energy, however, must, just as well as force, have a position in objective space, and under certain particular conditions the points from which energy proceeds may, just as well as the point from which force proceeds, change their place in space, so that the concept of matter as a substratum contained in space, is retained in both cases. The only difference, and it is indeed an important one, is that when we use the concept force, we presuppose the reducibility of all natural phenomena to

forms of mechanical motion, while when we use the concept of energy, we attribute to matter not only the property of motion without a change in the form of energy, but also the property of the transformability of qualitatively different forms of energy into one another without a change in the quantity of the energy.

3. The concept of *mind* is a supplementary concept of psychology, in the same way that the concept matter is a supplementary concept of natural science. It too is indispensable in so far as we need a concept which shall express in a comprehensive way the totality of psychical experiences in an individual consciousness. The content of the concept, however, is in this case also entirely dependent on the secondary concepts which give a more detailed definition of psychical causality. In the definition of this content psychology shared at first the fortune of the natural sciences. Both the concept of mind and that of matter arose primarily, not so much from the need of explaining experience as from the effort to reach a fanciful doctrine of the general interconnection of all things. But while the natural sciences have long since outgrown this mythological stage of speculative definition, and make use of some of the single ideas that originated at that time, only for the purpose of gaining definite starting points for a strict definition of their concepts, psychology has continued under the control of the mythological, metaphysical concept of mind down to most modern times, and still remains, in part at least, under its control. The concept mind is not used as a general supplementary concept which serves primarily to gather together the psychical facts and only secondarily to give a causal interpretation of them, but it is employed as a means of satisfying so far as possible the need of a general universal system, which system includes both nature and individual existence.

4. The *concept of a mind substance* in its various forms, is rooted in this mythological and metaphysical need. In the development of this concept there have not been wanting efforts to meet as far as possible, from the metaphysical position, the demand for a psychological causal explanation, but such efforts have in all cases been afterthoughts; and it is perfectly obvious that psychological experience alone, independent of all foreign metaphysical motives, would never have led to a concept of mind substance. This concept has beyond a doubt exercised a harmful influence on the scientific treatment of experience. The view, for example, that all the contents of psychical experience are ideas, and that these ideas are more or less permanent objects, would hardly be comprehensible without such presuppositions. That this concept is really foreign to psychology, is further attested by the close relation in which it stands to the concept of material substance. Mind substance is regarded either as identical with material substance, or else as distinct in nature, but still reducible in its most general formal characteristics to one of the particular forms of material elements, namely to the *atom.*

5. *Two* forms of the concept mind substance may be distinguished, corresponding to the two types of metaphysical psychology pointed out above (§ 2, p. 7). The one is *materialistic* and regards psychical processes as the activities of matter or of certain material complexes, such as the brain elements. The other is *spiritualistic* and looks upon psychical processes as states and changes in an unextended and therefore indivisible and permanent being of a specifically spiritual nature. In this case matter is thought of as made up of similar atoms of a lower order (monistic, or monadological spiritualism), or the mind atom is regarded as specifically different from matter proper (dualistic spiritualism) see table p. 18).

In both its materialistic and spiritualistic forms, the concept mind substance does nothing for the interpretation of psychological experience. Materialism does away with psychology entirely and puts in its place an imaginary brain physiology of the future, or when it tries to give positive theories, falls into doubtful and unreliable hypotheses of cerebral physiology. In thus giving up psychology in any proper sense, this doctrine gives up entirely the attempt to furnish any practical basis for the *mental sciences.* Spiritualism allows psychology as such to continue, but in such psychology actual experience is entirely subordinated to arbitrary metaphysical hypotheses, through which the unprejudiced observation of psychical processes is obstructed. This appears as a rule in the incorrect statement of the problem of psychology, with which the metaphysical theories start. Such theories regard inner and outer experience as totally heterogeneous, though in some external way interacting, spheres.

6. It has been shown (§ 1, p. 3) that the phases of experience dealt with in the natural sciences and in psychology are nothing but phases of *one* experience regarded from different points of view: in the natural sciences experience is treated as an interconnection of objective phenomena and, in consequence of the abstraction from the knowing subject, as *mediate experience;* in psychology experience is treated as *immediate and underived.*

When this relation is once understood, the *concept of a mind substance* immediately gives place to the *concept of the actuality of mind* as a basis for the comprehension of psychical processes. Since the psychological treatment of experience is supplementary to that of the natural sciences, in that it deals with the immediate reality of experience, it follows that there is no place in psychology for hypothetical supplementary concepts such as are necessary in the natural sciences because of the presupposition in the natural sciences of an object independent of the subject. The concept of the actuality of mind, accordingly, does not require any hypothetical determinants to define its particular contents, as does the concept of matter, but quite to the contrary, the concept of actuality excludes such hypothetical elements from the first, by defining the nature of mind as the immediate reality of the processes themselves. Still, since one important component of these processes, namely the totality of ideational objects, is at the same time, the subject of consideration in the natural sciences, it necessarily follows that substance and actuality are concepts that refer to one and the same general experience, with the difference that in each case experience is looked at from a different point of view. If we abstract from the knowing subject in our treatment of the world of experience, that world appears as a manifold of interacting substances; if, on the contrary, we regard the world of experience as the total content of the experience of the subject including the subject itself, then the world appears as a manifold of interrelated occurrences. In the first case, phenomena are looked upon as *outer phenomena*, in the sense that they would take place just the same, even if the knowing subject were not there at all, so that we may call the form of experience dealt with in the natural sciences *outer* experience. In the second case, on the contrary, all the contents of experience are regarded as belonging directly to the knowing subject, so that we may call the psychological attitude that of *inner* experience. In this sense outer and inner experience are identical with mediate and immediate, or with objective and subjective forms of experience. All these terms serve to designate, not different spheres of experience, but different supplementary points of view in the consideration of an experience which is presented to us as an absolute unity.

7. That the method of treating experience employed in natural science should have reached its maturity before that employed in psychology, is easily comprehensible in view of the practical interests connected with the discovery of regular natural phenomena thought of as independent of the subject. It was, furthermore, almost unavoidable that this priority of the natural sciences should, for a long time, lead to a confusion of the two points of view. This did really occur as we see by the different psychological substance concepts. When the reform came in the fundamental position of psychology, and the characteristics and problems of this science were sought, not in the specifically distinct nature of its sphere, but in its method of considering all the contents presented to us in experience in their immediate reality, unmodified by any hypothetical supplementary concepts — when this reform came it did not originate in psychology itself, but in the *single mental sciences*. The view of mental processes based upon the concept of actuality, was familiar in these mental sciences long before it was accepted in psychology. This inadmissible difference between the fundamental position of psychology and the mental sciences is what has kept psychology until the present time, from fulfilling its mission as a foundation for all the mental sciences.

8. When the concept of actuality is adopted, one of the questions on which metaphysical systems of psychology have been long divided is immediately disposed of. This is the question of the *relation of body and mind*. So long as body and mind are both regarded as substances, this relation must remain an enigma in whatever way the two concepts of substance may be defined. If they are like substances, then

the different contents of experience as dealt with in the natural sciences and in psychology can no longer be understood, and there is no alternative but to deny the independence of one of these forms of knowledge. If they are unlike substances, their connection is a continual miracle. If we start with the theory of the actuality of mind, we recognize the immediate reality of the phenomena in psychological experience. Our physiological concept of the bodily organism, on the other hand, is nothing but a part of this experience, which we gain, just as we do all the other empirical contents of the natural sciences, by assuming the existence of an object independent of the knowing subject. Certain components of mediate experience may correspond to certain components of immediate experience, without there being any necessity for this reason of reducing the one component to the other or of deriving one from the other. In fact, such a derivation is absolutely impossible because of the totally different points of view adopted in the two cases. Still, the fact that we have here, not different objects of experience, but different points of view in looking at a unitary experience, renders necessary the existence at every point, of relations between the two. At the same time it must be remembered that there is an infinite number of objects which can be approached only mediately, through the method of the natural sciences: here belong all those phenomena which we are not obliged to regard as physiological substrata of psychical processes. On the other hand, there is just as large a number of important facts which are presented only immediately, or in psychological experience: these are all those contents of our subjective consciousness which do not have the character of ideational objects, that is, are not directly referred to external objects. This includes our whole world of feeling so long as this world is considered entirely from the point of view of its subjective significance.

9. As a result of this relation, it follows that there must be a necessary relation between all the facts that belong at the same time to both kinds of experience, that is, to the mediate experience of the natural sciences and to the immediate experience of psychology, for these two kinds of experience are nothing but phases of a single experience which is merely regarded in the two cases from different points of view. Since certain facts belong to both spheres, there must be an elementary process on the physical side, corresponding to every such process on the psychical side. This general principle is known as the *principle of psychophysical parallelism.* It has an empirico-psychological significance and is thus totally different from certain metaphysical principles which have sometimes been designated by the same name, but which have in reality an entirely different meaning. These metaphysical principles are all based on the hypothesis of a psychical substance. They all seek to solve the problem of the interrelation of body and mind, either by assuming *two* real substances with attributes which are different, but parallel in their changes, or by assuming *one* substance with two distinct attributes which correspond in their modifications. In both these cases the metaphysical principle of parallelism is based on the assumption that every physical process has a corresponding psychical process and vice versa; or it is based on the assumption that the mental world is a mirroring of the bodily world, or that the bodily world is an objective realization of the mental. This assumption is, however, entirely indemonstrable and leads in its psychological application to an intellectualism which is contradictory to all experience. The psychological principle, on the other hand,

as above formulated, starts with the assumption that there is only *one* experience, which, however, as soon as it becomes the subject of scientific analysis, is, in some of its components, open to *two* different kinds of scientific treatment: to a mediate form of treatment, which investigates ideated objects in their objective relations to one another, and to an *immediate* form, which investigates the same objects in their directly known character, and in their relations to all the other contents of the experience of the knowing subject. So far as there are objects to which both these forms of treatment are applicable, the psychological principle of parallelism requires relation at every point between the processes on the two sides. This requirement is justified by the fact that both forms of analysis are in these two cases really analyses of one and the same content of experience. On the other hand, from the very nature of the case, the psychological principle of parallelism can *not* apply to those contents of experience which are objects of natural-scientific analysis alone, or to those which go to make up the specific character of psychological experience. Among the latter we must include the characteristic *combinations* and *relations* of psychical elements and compounds. To be sure, there are combinations of physical processes running parallel to the psychical processes, in so far at least as a direct or indirect causal relation must exist between the physical processes the regular coexistence or succession of which is indicated by a psychical interconnection, but the characteristic content of the psychical combination can, of course, in no way be a part of the causal relation between the physical processes. Thus, for expample, the elements that enter into a spacial or temporal idea, stand in a regular relation of coexistence and succession in their physiological substrata; or the ideational elements that make up a process in which psychical contents are related or compared, have corresponding combinations of physiological excitation of some kind or other, which are repeated whenever these psychical processes take place. But the physiological processes can not contain anything of that which goes to form the specific nature of spacial and temporal ideas, or anything of that which goes to form the relating and comparing processes, because natural science purposely abstracts from all that is here concerned. Then, too, there are two concepts that result from the psychical combinations, which, together with their related affective elements, lie entirely outside the sphere of experience to which the principle of parallelism applies. These are the concepts of *value* and *end*. The forms of combination which we see in processes of fusion or in associative and apperceptive processes, as well as the values that they possess in the whole interconnection of psychical development, can only be understood through *psychological* analysis, in the same way that objective phenomena, such as those of weight, sound, light, heat, etc., or the processes of the nervous system, can be approached only through physical and physiological analysis, that is, through analysis which makes use of the supplementary substance-concepts of natural science.

10. Thus, the principle of psycho-physical parallelism in the incontrovertible *empirico-psychological* significance above attributed to it, leads necessarily to the recognition of an *independent psychical causality*, which is related at all points to physical causality and can never come into contradiction with it, but is just as different from this physical causality as the point of view adopted in psychology, or that of immediate, subjective experience, is different from the point of view taken in the natural sciences, or that of mediate, objective experience due to abstraction. And just as the nature

of physical causality can be revealed to us only in the fundamental *laws of nature*, so the only way in which we can account for the characteristics of psychical causality is to abstract certain *fundamental laws of psychical phenomena* from the totality of psychical processes. We may distinguish *two* classes of such laws. The laws of one class show themselves primarily in the processes which condition the rise and immediate interaction of the psychical compounds; we call these the *psychological laws of relation*. Those of the the second class are derived laws. They consist in the complex effects which are produced by combinations of the laws of relation within more extensive series of psychical facts; these we call the *psychological laws of development*. In order to understand the real value of these laws one must bear in mind the fact that their significance depends, just as does the significance of natural-scientific laws, not on their mere abstract form, but on the degree in which they can be applied to particular cases. Thus, the principle of inertia would seem to be, if considered merely in its abstract form, a hazy proposition. Its value comes out only in particular mechanical and physical applications.

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§ 23. PSYCHOLOGICAL LAWS OF RELATION.

1. There are *three* general psychological laws of relation. We designate them as the laws *of psychical resultants*, *of psychical relations*, and *of psychical contrasts*.

2. The *law of psychical resultants* finds its expression in the fact that every psychical compound shows attributes which may indeed be understood from the attributes of its elements after these elements have once been presented, but which are by no means to be looked upon as the mere sum of the attributes of these elements. A compound clang is more in its ideational and affective attributes than merely a sum of single tones. In spacial and temporal ideas the spacial and temporal arrangement is conditioned, to be sure, in a perfectly regular way by the combination of elements which make up the idea, but still the arrangement itself can by no means be regarded as a property of the sensational elements themselves. The nativistic theories that assume this, implicate themselves in contradictions that cannot be solved; and besides, in so far as they admit subsequent changes in the original space perceptions and time perceptions, they are ultimately driven to the assumption of the rise, to some extent at least, of new attributes. Finally, in the apperceptive functions and in the activities of imagination and understanding, this law finds expression in a clearly recognized form. Not only do the elements united by apperceptive synthesis gain, in the aggregate idea which results from their combination, a new significance which they did not have in their isolated state, but what is of still greater importance, the aggregate idea itself is a new psychical content made possible, to be sure, by the elements, but by no means contained in these elements. This appears most

strikingly in the more complex productions of apperceptive synthesis, as, for example, in a work of art or a train of logical thought.

3. The law of psychical resultants thus expresses a principle which we may designate, in view of its results, as the *principle of creative synthesis*. This principle has long been recognized in the case of higher mental creations, but it has not been generally applied to the other psychical processes. In fact, through an unjustifiable confusion with the laws of physical causality, it has even been completely reversed. A similar confusion is responsible for the notion that there is a contradiction between the principle of creative synthesis in the mental world and the general laws of the natural world, especially the law of the conservation of energy. Such a contradiction is impossible from the outset because the points of view of judgment, and therefore of measurements wherever such are made, are different in the two cases, and must be different, since natural science and psychology deal, not with different contents of experience, but with one and the same content viewed from different sides (§ 1, p. 3). Physical measurements have to do with *objective masses, forces, and energies*. These are supplementary concepts which we are obliged to use in judging objective experience; and their general laws, derived as they are from experience, must not be contradicted by any single case of experience. Psychical measurements, which are concerned with the comparison of psychical components and their resultants, have to do with *subjective values and ends*. The subjective value of the psychical combination may be greater than the value of its components; its purpose may be different and higher than theirs, without any change in the masses, forces, and energies concerned. The muscular movements of an external volitional act, the physical processes

which accompany sense perception, association, and apperception, all follow invariably the principle of the conservation of energy. But the mental values and ends which these energies represent may be very different in quantity even while the quantity of these energies remains the same.

4. The differences pointed out show that *physical* measurement deals with *quantitative values,* that is, with quantities that admit of a variation in value only in the one relation of the quantity of the phenomena measured. *Psychical* measurement, on the other hand, deals in the last instance in every case with *qualitative values*, that is, values that vary in degree only in respect to their qualitative character. The ability to produce purely *quantitative* effects, which we designate as *physical energy* is, accordingly, to be clearly distinguished from the ability to produce *qualitative* effects, or the ability to produce values, which we designate as *psychical energy*.

On this basis we can not only reconcile the *increase of psychical energy* with the *constancy of psychical energy* as accepted in the natural sciences, but we find also in the two facts reciprocally supplementary standards for the judgment of our total experience. The increase of psychical energy is not seen in its right light until it is recognized as the reserve, subjective side of physical constancy. The increase of psychical energy, being as it is indefinite, since the standard may be very different under different conditions, holds only *under the condition that the psychical processes are continuous.* As the psychological correlate of this increase we have the fact which forces itself upon us in experience, that *psychical values disappear*.

5. The *law of psychical relations* supplements the law of resultants; it refers not to the relation of the components of

a psychical interconnection to the value of the whole, but rather to the reciprocal relations of the psychical components within a compound. The law of resultants thus holds for the synthetic processes of consciousness, the law of relations for the analytic. Every resolution of a conscious content into its single members is an act of relating analysis. Such a resolution takes place in the successive apperception of the parts of a whole which whole is ideated at first only in a general way, a process which is to be seen in sense perceptions and associations, and in clearly recognized form in the division of aggregate ideas. In the same way, every apperception is an analytic process the two phases of which are the emphasizing of a single content, and the marking off of this one content from all others. The first of these two partial processes is what produces *clearness*, the second is what produces *distinctness* of apperception (p. 228, 4). The most complete expression of this law is to be found in the processes of *apperceptive analysis* and in the simple *relating* and *comparing* functions upon which such analysis is based (p. 278 and 292). In comparison more especially, we see the essential import of the law of relations in the principle that every single psychical content receives its significance from the relations in which it stands to other psychical contents. When these relations are *quantitative*, this principle takes the form of a principle of *relative quantitative comparison* such as is expressed in *Weber's law* (p. 283).

6. The third law, the *law of psychical contrasts* is, in turn, supplementary to the law of relations. It refers, like the law of relations, to the relations of psychical contents to one another. It is itself based on the fundamental division of the immediate contents of experience into objective and subjective components, a division which is due to the

very conditions of psychical development. Under subjective components are included all the elements and combinations of elements which, like the feelings and emotions, are essential constituents of *volitional processes*. These subjective components are all arranged in groups made up of opposite qualities corresponding to the chief affective dimensions of pleasurable and unpleasurable feelings, exciting and depressing feelings, and straining and relaxing feelings (p. 92). These opposites obey in their succession the general *law of intensification through contrast*. In its concrete application, this law is always determined in part by special temporal conditions, for every subjective state requires a certain period for its development; and if, when it has once reached its maximum, it continues for a long time, it loses its ability to arouse the contrast effect. This fact is connected with another fact, namely that there is a certain medium, though greatly varying, rate of psychical processes most favorable for the intensity of all feelings and emotions.

This law of contrast has its origin in the attributes of the subjective contents of experience, but is secondarily applied also to ideas and their elements, for ideas are always accompanied by more or less emphatic feelings due either to the ideational content or to the character of the spacial and temporal combinations involved. Thus the principle of intensification through contrast finds its broader application most clearly in the case of certain sensations, such as those of sight, and in the case of spacial and temporal ideas.

7. The law of contrast stands in close relation to the two preceding laws. On the one hand, it may be regarded as the application of the general law of relations to the special case in which the related psychical contents range

between opposites. On the other hand, the fact that under suitable circumstances antithetical psychical processes may intensify each other, while falling under the law of contrast, is at the same time a special application of the principle of creative synthesis.

References. Wundt, Ueber psychische Causalität, Philos. Studien, vol. 10, and Logik, vol. II, Pt. 2, Sect. 4, chap. 2, § 4, and System der Philosophie, 2nd. ed., Sect. 6.

§ 24. PSYCHOLOGICAL LAWS OF DEVELOPMENT.

1. We have as many psychological laws of development as we had laws of relation, and the former may be regarded as the application of the latter to more comprehensive psychical interconnections. We designate the laws of development as laws first of *mental growth*, second of *heterogony of ends*, and third of *development toward opposites.*

2. The *law of mental growth* is as little applicable to all contents of psychical experience as is any other psychological law of development. It holds only under the limiting condition which applies to the law of resultants, the application of which it is, namely the condition of the *continuity of the processes* (p. 366). But since the circumstances that tend to prevent the realization of this condition, are, of course, much more frequent when the mental developments concerned include a greater number of psychical syntheses, than in the case of the single syntheses themselves, it follows that the law of mental growth can be demonstrated only for certain developments taking place under normal conditions, and even here only within certain limits. Within these limits, however, the more comprehensive developments, as, for example, the mental development of the normal individual and the development of mental communities, are

obviously the best exemplifications of the fundamental law of resultants, which law lies at the basis of this development.

3. The *law of heterogony of ends* is most closely connected with the law of relations, but it is also based on the law of resultants, which latter is always to be taken into consideration when dealing with the larger interconnections of psychical development. In fact, we may regard this law of heterogony of ends as a principle of development which controls the changes arising, as results of successive creative syntheses, in the relations between the single partial contents of psychical compounds. The resultants arising from united psychical processes include contents which were not present in the components, and these new contents may in turn enter into relation with the old components, thus changing again the relations between these old components and consequently changing the new resultants which arise. This principle of continually changing relations is most strikingly illustrated when an *idea of ends* is formed on the basis of the given relations. In such cases the relation of the single factors to one another is regarded as an interconnection of means, which interconnection has for its end the product arising from the interconnection. The relation between the actual *effects* in such a case and the ideated ends, is such that secondary effects always arise which were not thought of in the first ideas of end. These new effects enter into new series of motives, and thus modify the earlier ends or add new ends to the earlier ones.

The principle of heterogony of ends in its broadest sense dominates all psychical processes. In the special teleological coloring which has given it its name, however, it is to be found primarily in the sphere of *volitional processes*, for here the ideas of end together with their affective motives are of the chief importance. Of the various spheres of applied psychology, it is therefore especially *ethics* for which this law is of great importance.

4. The *law of development towards opposites* is an application of the law of intensification through contrast, to more comprehensive interconnections which form in themselves series of developments. In such series of developments there is a constant play of contrasting feelings in accordance with the fundamental law of contrasts. First, certain feelings and impulses of small intensity begin to arise. Through contrast with the predominating feelings this rising group increases in intensity until finally it gains the complete ascendency. This ascendency is retained for a time and then from this point on the same alternation may be once or even several times repeated. But generally the principles of mental growth and heterogony of ends operate in the case of such an oscillation, so that succeeding phases though they are like corresponding antecedent phases in their general affective direction, yet differ essentially in their special components.

The law of development towards opposites shows itself in the mental development of the individual, partly in a purely individual way within shorter periods of time, and partly in certain universal regularities in the relation of various periods of life. It has long been recognized that the predominating temperaments of different periods of life present certain contrasts. Thus, the light, sanguine excitability of childhood, which is seldom more than superficial, is followed by the slower but more retentive temperament of youth with its frequent touch of melancholy. Then comes manhood with its mature character, generally quick and active in decision and execution, and last of all, old age with its leaning toward contemplative quiet. Even more than in the individual does this principle of antithesis find expression in the alternation of mental tendencies which appear in social and historical life, and in the reactions of these mental tendencies on civilization and customs and on social and political development. As the principle of heterogony of ends applied chiefly to the domain of *moral* life, so this principle of development towards opposites finds its chief significance in the more general sphere of *historical* life.

References. Compare § 23, page 369.

GLOSSARY.

Accord	chord.
Affect	emotion.
angeboren	connate.
Anschaulich	perceptual (p. 5).
Anschaung	perception.
Raum-	space p.
Zeit-	time p.
Apperception	apperception.
-function	apperceptive function.
personificirende	personifying.
-verbindung	apperceptive combination.
Assimilation	assimilation.
Association	association.
Aehnlichkeits-	by similarity.
Berührungs-	by contiguity.
Gleichheits-	by identity.
reihweise	serial.
Auffassung	perception, apperception (see *Perception*), or looser forms of expression as view, recognition, etc.
Aufmerksamkeit	attention.
Aufrechtsehen	erect vision.
Bedingung	condition.
Begleiterscheinung	concomitant or accompanying phenomenon.
Begriff	concept, (sometimes in looser sense) definition.
Actualitäts- der Seele	concept of the actuality of mind.
Allgemein-	general c.
Hülfs-	supplementary c.

Begriff Werth-	c. of value.
Zweck-	c. of end.
begrifflich	conceptual.
Beobachtung	observation.
Selbst-	introspection.
Beweggrund	reason for action.
Bewegung	movement.
Ausdrucks-	expressive m.
mimische	mimetic m.
pantomimische	pantomimetic m.
Bewusstsein	consciousness.
Gesammt-	collective c.
Selbst-	self-c.
Beziehung	relation.
Complication	complication.
Contrast	contrast.
Farben-	color c.
Licht-	light c.
Rand-	marginal c.
Dauer	duration.
Nach-	persistence.
Deutlichkeit	distinctness.
Doppelbilder	double images.
Druck	pressure.
-punkt	p.-spot.
Eigenschaft	attribute or property.
Eindruck	impression.
Elemente	elements.
Empfindlichkeit	sensitivity.
Empfindung	sensation.
Druck-	s. of pressure or pressure s.
Farben-	color s. or s. of chromatic light.
farblose	achromatic s. or s. of achromatic light.
Helligkeits-	s. of brightness.
Geruchs-	s. of smell.
Geschmacks-	s. of taste.
Haupt-	principal s.
Haut-	cutaneous s.
Kälte-	s. of cold.

Empfindung Licht-	light s. or s. of light.
Schall-	s. of sound or sound s.
Schmerz-	pain s. or s. of pain.
Ton-	tonal s. or tone s.
Wärme-	s. of heat.
Entscheidung	resolution.
Enschliessung	decision.
Entstehung	rise.
Entwickelung	development.
regressive	retrogradation.
Erfahrung	experience.
mittelbare	mediate.
unmittelbare	immediate.
Erinnerungsbild	memory image.
Erinnerungsvorgang	memory process.
Erkennung	cognition.

Farben	colors.
Ergänzungs-	complementary c.
-ton	c. tone.
Gegen-	opposite c.
Grund-	fundamental c.
Fixationslinie	line of fixation.
Fixationspunkt	fixation-point or point of fixation.

Gebilde	compound.
Gedächtniss	memory.
Gefallen	agreeable feeling.
Gefühle	feelings.
allmählich ansteigende	gradually arising.
Anfangs-	inceptive f.
Begiffs-	conceptual f.
Bekanntheits-	f. of familiarity.
beruhigende	quieting f.
Contrast-	contrast f.
deprimirende	depressing f.
End-	terminal f.
Erinnerungs-	f. of remembering.
Erkennungs-	f. of cognition.
Erleiden (G. des)	f. of passive receptivity.
excitirende	exciting f.
Form-	f. of form.
-ton	affective tone.

Gefühle Gemein-	common f.
lösende	relaxing f.
Lust-	pleasurable f.
rhythmische	f. of rhythm.
sinnliche	sense-f.
spannende	straining f.
Thätigkeits-	f. of activity.
Total-	total f.
Unlust-	unpleasurable f.
zusammengesetzte	composite f.
Geisteserzeugniss	mental product.
Geisteswissenschaft	mental science.
geistig	mental.
Gemeinschaft	community.
Gemüthsbewegung	affective process.
Gemüthslage oder Gemüthszustand	affective state.
Geräusch	noise.
Geschehen	phenomena.
Gesetz	law.
Beziehungs-	l. of relation.
G. d. Contraste	l. of contrasts.
G. d. Relationen	l. of relations.
G. d. Resultante	l. of. resultants.
G. d. Entwicklung in Gegensätzen	l. of development towards opposites.
G. d. Heterogonie der Zwecke	l. of heterogony of ends.
G. d. geistigen Wachsthums	l. of mental growth.
Gesichtswinkel	visual angle.
Grössenbestimmung	measurement.
Handlung	act, action.
Helligkeit	brightness.
Hemmung	inhibition.
Illusion	illusion.
phantastische	i. of fancy.
Indifferenzzone	indifference-zone.
Inhalt	content.
Klang	clang.
Einzel-	single cl.
-farbe	clang-color.

Klang Zusammen-	compound cl.
Klarheit	clearness.
Localisationschärfe	keenness of localization.
Localzeichen	local signs.
Methode	method.
Abzählungs-	calculation m.
Ausdrucks-	expression m.
Eindrucks-	impression m.
Einstellungs-	adjustment m.
der Minimaländerung	m. of minimal changes.
d. minimalen Unterschiede	m. of minimal differences.
d. mittleren Fehler	of average error.
Missfallen	disagreeable feeling.
Nachbild	after image.
Nahrungsinstinct	alimentive instinct.
Orientation	orientation, or location in relation to.
-linie	line of orientation.
-punkt	point of orientation.
Perception	apprehension.
Phantasie	imagination.
Punkt	point or spot.
Druck-	pressure-sp.
Kälte-	cold-sp.
Wärme-	heat-sp.
Raum	space.
Reaction	reaction.
zusammengesetzte	compound r.
Recht	law.
Reiz	stimulus.
Richtung	direction, or (figuratively) theory, form of.
Sättigung	saturation.
Schema	scheme.
Schmerz	pain.
Schöpferische Synthese	creative synthesis.

Schwebungen	beats.
Schwelle	threshold.
Raum-	space t.
Reiz-	stimulus t.
Seele	mind.
Sehfeld	field of vision.
Sehschärfe	keenness of vision.
Sinn	sense.
Sitte	custom.
Sprache	speech or language.
Geberden	gesture l.
Laut-	articulate l.
Suggestion	suggestion.
System	system.
gleichförmiges	homogeneous s.
mannigfaltiges	complex s.

Tiefe	depth or third dimension.
Töne	tones.
Differenz-	difference-t.
Grund-	fundamental t.
Ober-	overtones.
Stoss-	beat t.
Tonempfindung	tonal sensation or sensation of t.
Tonhöhe	pitch.
-linie	tonal line.
-scala	tonal scale.
-stösse	tonal beats.
Trieb	impulse.
-feder	impelling feeling.
-handlung	impulsive act.
Spiel-	play impulse.

Umfang	scope.
Urtheil	judgment.

Verbindung	combination.
Vergleichung	comparison.
Verhältniss	relation or proportion.
Verschmelzung	fusion.
Verstand	understanding.
Völkerpsychologie	social psychology.
Vorgang	process.

Vorstellung	idea.
Gehör-	auditory i.
Gesammt-	aggregate i.[1]
Gesichts-	visual i.
räumliche	spacial i.
Raum-	space i.
zeitliche	temporal i.
Zeit-	time i.

Wahrnehmung	sense-perception.
Wesen	nature.
Wiedererkennung	recognition.
sinnliche	sensible r.
Wille	will.
Gesammt-	collective w.
Wahl- (z. B. Vorgang)	selective (process).
Willens- („ „)	volitional (p.)
Willkür- („ „)	voluntary (p.)

Zeitarten	temporal modes.
Zeitstufen	t. stages.
Zeitzeichen	t. signs.
Zusammenhang	interconnection.
Zustände	states.
Zweckmässig	purposive.

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[1] For this translation I am indebted to Prof. Titchener.

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